SEP 19 2000

0629-E-10 I 53.59/2:V59/2

U.S. Department of the Interior

Bureau of Land Management
Rock Springs Field Office

August 2000

Environmental Assessment for the Vermillion Basin Natural Gas Exploration and Development Project

2002-005310/NF C

MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

WY-040-EA00-094

I

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Rock Springs Field Office
280 Highway 191 North
Rock Springs, Wyoming 82901-3447

1792 (040)

August 9, 2000

Vermillion Basin Project

Dear Reviewer:

Wexpro Company, Questar Exploration and Production Company, Marathon Company, Basin Exploration, and other natural gas operators propose to expand natural gas exploration and development of their oil and gas leases in the Vermillion Basin area. The project area is located approximately 45 miles southeast of Rock Springs and within the Bureau of Land Management's Rock Springs Field Office area. Drilling and production in this area has occurred since the mid-1940s. The proponents propose to drill up to 56 additional natural gas wells in the area. Currently there are 82 producing wells. The environmental assessment (EA) for the proposed Vermillion Basin Natural Gas Exploration and Development Project is provided to you for review and comment. Written comments will be considered in the Decision Record if they are received by September 11, 2000.

Comments may be submitted via regular mail to:

Teri Deakins, Project Manager
Bureau of Land Management - Rock Springs Field Office
280 Highway 191 North
Rock Springs, Wyoming 82901

or be submitted electronically at:

rock_springs_wymail@blm.gov (please be sure to state Vermillion Basin in subject line).

Comments, including the names and street addresses of respondents, will be made available for review by the public at the address listed above during regular business hours (7:45 a.m. to 4:30 p.m.), Monday through Friday, except holidays, and could be published as part of the Decision Record. However, individual respondents may request confidentiality. If you wish to withhold your name and/or street address from public review or from disclosure under the Freedom of Information Act, you must state so prominently at the beginning of your written or electronic comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

We appreciate you taking the time to participate in this analysis process. Your involvement enhances the integrity of the EA which helps me make a better informed decision. Should you have any questions, please contact Teri Deakins at 307-352-0211.

Sincerely

Stan McKee

Field Manager

Attachment

ENVIRONMENTAL ASSESSMENT FOR THE VERMILLION BASIN NATURAL GAS EXPLORATION AND DEVELOPMENT PROJECT

Prepared for

Bureau of Land Management
Rock Springs Field Office
Rock Springs, Wyoming

This Environmental Assessment was prepared by TRC Mariah Associates Inc., an environmental consulting firm, with the guidance, participation, and independent evaluation of the Bureau of Land Management (BLM). The BLM, in accordance with Title 40 Code of Federal Regulations, Part 1506(a) and (b), is in agreement with the findings of the analysis and approves and takes responsibility for the scope and content of this document.

August 2000

IV

TABLE OF CONTENTS

Page

ABBREVIATIONS AND ACRONYMS xi

1.0 INTRODUCTION 1
  1.1 PURPOSE AND NEED 3
  1.2 CONFORMANCE AND AUTHORIZATION ACTIONS 4
  1.3 LAND AND RESOURCE MANAGEMENT ISSUES AND CONCERNS 8

2.0 THE PROPOSED ACTION AND NO ACTION ALTERNATIVE 13
  2.1 THE PROPOSED ACTION 16
    2.1.1 Pre-construction Activities 18
    2.1.2 Construction and Drilling 19
      2.1.2.1 Well Pad Construction 19
      2.1.2.2 Road Construction 21
      2.1.2.3 Drilling Operations 26
    2.1.3 Well Completion and Testing 29
    2.1.4 Production 31
    2.1.5 Pipelines 34
    2.1.6 Operations and Maintenance 36
      2.1.6.1 Maintenance 36
      2.1.6.2 Workovers 36
    2.1.7 Ancillary Facilities/Gravel Pit 36
    2.1.8 Workforce and Traffic 37
    2.1.9 Transportation 40
    2.1.10 Geophysical Activities 41
    2.1.11 Reclamation and Abandonment 42
    2.1.12 Hazardous Materials 44
    2.1.13 Applicant-Committed Practices 52
      2.1.13.1 Preconstruction Planning and Design Measures 53
      2.1.13.2 Air Quality 54
      2.1.13.3 Topography and Physiography 55
      2.1.13.4 Geological/Paleontological Resources 56
      2.1.13.5 Soils 57
      2.1.13.6 Water Resources 58
      2.1.13.7 Noise and Odor 62
      2.1.13.8 Vegetation 63
      2.1.13.9 Wildlife and Fisheries 65
      2.1.13.10 Cultural and Historic Resources 71
      2.1.13.11 Socioeconomics 73
      2.1.13.12 Livestock/Grazing Management 73
      2.1.13.13 Land Status/Use 74

✓

TABLE OF CONTENTS (Continued)

Page

2.1.13.14 Recreation 75
2.1.13.15 Transportation 75
2.1.13.16 Visual Resources 77
2.1.13.17 Health and Safety/Hazardous Materials 77
2.2 THE NO ACTION ALTERNATIVE 78
2.3 ALTERNATIVES CONSIDERED BUT REJECTED 79
2.4 SUMMARY OF ENVIRONMENTAL IMPACTS 80

3.0 AFFECTED ENVIRONMENT 83
3.1 PHYSICAL RESOURCES 83
3.1.1 Climate 83
3.1.2 Air Quality 85
3.1.3 Topography and Physiography 85
3.1.4 Geology and Geological Hazards 88
3.1.5 Paleontological Resources 89
3.1.6 Mineral Resources 92
3.1.7 Soils 92
3.1.8 Water Resources 95
3.1.8.1 Surface Water 95
3.1.8.2 Ground Water 101
3.1.9 Noise and Odor 103
3.2 BIOLOGICAL RESOURCES 104
3.2.1 Vegetation and Wetlands 104
3.2.2 Wildlife and Fisheries 107
3.2.2.1 Big Game 107
3.2.2.2 Other Mammals 111
3.2.2.3 Raptors 113
3.2.2.4 Upland Game Birds 113
3.2.2.5 Other Birds 115
3.2.2.6 Amphibians and Reptiles 115
3.2.2.7 Fisheries 115
3.2.3 Wild Horses 116
3.2.4 Threatened, Endangered, Proposed, and Candidate Species . . . 116
3.2.4.1 TEP&C Animal Species 119
3.2.4.2 TEP&C Plant Species 123
3.3 CULTURAL RESOURCES 125
3.3.1 Cultural Resource Inventories 125
3.3.2 Prehistoric Site Types and Distributions 126
3.3.3 Native American Sensitive Sites and Traditional Cultural Properties 126
3.3.4 Historic Site Types and Distributions 127

TABLE OF CONTENTS (Continued)

Page

3.4 SOCIOECONOMICS/ENVIRONMENTAL JUSTICE 128
3.5 LANDOWNERSHIP AND USE 131
  3.5.1 Pine Mountain Management Area 131
  3.5.2 Livestock Grazing 133
  3.5.3 Transportation 137
  3.5.4 Recreation 137
3.6 AESTHETICS AND VISUAL RESOURCES 137
3.7 HAZARDOUS MATERIALS 138

4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION 139
  4.1 PHYSICAL RESOURCES 142
    4.1.1 Air Quality 142
      4.1.1.1 The Proposed Action 142
      4.1.1.2 The No Action Alternative 144
      4.1.1.3 Mitigation 144
      4.1.1.4 Cumulative Impacts 144
      4.1.1.5 Unavoidable Adverse Impacts 144
    4.1.2 Topography and Physiography 145
      4.1.2.1 Proposed Action 145
      4.1.2.2 No Action 146
      4.1.2.3 Mitigation 147
      4.1.2.4 Cumulative Impacts 147
      4.1.2.5 Unavoidable Adverse Impacts 147
    4.1.3 Geology and Geologic Hazards 148
      4.1.3.1 The Proposed Action 148
      4.1.3.2 No Action Alternative 148
      4.1.3.3 Mitigation 149
      4.1.3.4 Cumulative Impacts 149
      4.1.3.5 Unavoidable Adverse Impacts 149
    4.1.4 Paleontological Resources 149
      4.1.4.1 The Proposed Action 150
      4.1.4.2 The No Action Alternative 150
      4.1.4.3 Mitigation 150
      4.1.4.4 Cumulative Impacts 151
      4.1.4.5 Unavoidable Adverse Impacts 151
    4.1.5 Mineral Resources 151
      4.1.5.1 The Proposed Action 152
      4.1.5.2 No Action Alternative 152
      4.1.5.3 Mitigation 152
      4.1.5.4 Cumulative Impacts 153
      4.1.5.5 Unavoidable Adverse Impacts 153

TABLE OF CONTENTS (Continued)

Page

- 4.1.6 Soils 153
  - 4.1.6.1 The Proposed Action 154
  - 4.1.6.2 No Action Alternative 157
  - 4.1.6.3 Mitigation 157
  - 4.1.6.4 Cumulative Impacts 159
  - 4.1.6.5 Unavoidable Adverse Impacts 160
- 4.1.7 Water Resources 160
  - 4.1.7.1 The Proposed Action 161
  - 4.1.7.2 No Action Alternative 162
  - 4.1.7.3 Mitigation 163
  - 4.1.7.4 Cumulative Impacts 163
  - 4.1.7.5 Unavoidable Adverse Impacts 164
- 4.1.8 Noise and Odor 164
  - 4.1.8.1 The Proposed Action 164
  - 4.1.8.2 No Action Alternative 166
  - 4.1.8.3 Mitigation 166
  - 4.1.8.4 Cumulative Impacts 166
  - 4.1.8.5 Unavoidable Adverse Impacts 166

4.2 BIOLOGICAL RESOURCES 166
- 4.2.1 Vegetation and Wetlands 166
  - 4.2.1.1 The Proposed Action 167
  - 4.2.1.2 No Action Alternative 168
  - 4.2.1.3 Mitigation 169
  - 4.2.1.4 Cumulative Impacts 169
  - 4.2.1.5 Unavoidable Adverse Impacts 169
- 4.2.2 Wildlife and Fisheries 169
  - 4.2.2.1 The Proposed Action 171
  - 4.2.2.2 No Action Alternative 177
  - 4.2.2.3 Mitigation 178
  - 4.2.2.4 Cumulative Impacts 178
  - 4.2.2.5 Unavoidable Adverse Impacts 180
- 4.2.3 Wild Horses 180
  - 4.2.3.1 The Proposed Action 180
  - 4.2.3.2 No Action Alternative 181
  - 4.2.3.3 Mitigation 181
  - 4.2.3.4 Cumulative Impacts 181
  - 4.2.3.5 Unavoidable Adverse Impacts 182
- 4.2.4 Threatened, Endangered, Proposed, and Candidate Species 182
  - 4.2.4.1 The Proposed Action 183
  - 4.2.4.2 No Action Alternative 185
  - 4.2.4.3 Mitigation 186

TABLE OF CONTENTS (Continued)

Page

4.2.4.4 Cumulative Impacts 186
4.2.4.5 Unavoidable Adverse Impacts 186
4.3 CULTURAL RESOURCES 187
4.3.1 The Proposed Action 187
4.3.2 No Action Alternative 188
4.3.3 Mitigation and Monitoring 189
4.3.4 Cumulative Impacts 191
4.3.5 Unavoidable Adverse Impacts 191
4.4 SOCIOECONOMICS 191
4.4.1 The Proposed Action 192
4.4.2 The No Action Alternative 194
4.4.3 Mitigation 194
4.4.4 Cumulative Impacts 194
4.4.5 Unavoidable Adverse Impacts 194
4.5 LANDOWNERSHIP AND USE 195
4.5.1 The Proposed Action 196
4.5.2 No Action Alternative 199
4.5.3 Mitigation 199
4.5.4 Cumulative Impacts 200
4.5.5 Unavoidable Adverse Impacts 200
4.6 AESTHETICS AND VISUAL RESOURCES 200
4.6.1 The Proposed Action 201
4.6.2 No Action Alternative 201
4.6.3 Mitigation 202
4.6.4 Cumulative Impacts 202
4.6.5 Unavoidable Adverse Impacts 202
4.7 HAZARDOUS MATERIALS 202
4.7.1 The Proposed Action 203
4.7.2 No Action Alternative 203
4.7.3 Mitigation 204
4.7.4 Cumulative Impacts 204
4.7.5 Unavoidable Adverse Impacts 204
4.8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES 204
4.9 SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY 205

5.0 RECORD OF PERSONS, GROUPS, AND GOVERNMENTAL AGENCIES CONTACTED 207

6.0 REFERENCES 211

LIST OF MAPS

Page

Map 1.1 Location of the Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 2

Map 2.1 Existing and Proposed Developments, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 14

Map 3.1 Known Faults, Springs, and Seeps on the Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 90

Map 3.2 Southwestern Wyoming Oil and Gas Development Areas 93

Map 3.3 Tributary Sub-watersheds Within the Vermillion Watershed, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 . . 97

Map 3.4 Antelope Herd Units and Range Types, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 109

Map 3.5 Known White-tailed Prairie Dog Towns, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 112

Map 3.6 Known Raptor Nests and Sage Grouse Leks, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 114

Map 3.7 Surface Landownership, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 132

Map 3.8 Grazing Allotments, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 136

LIST OF FIGURES

Page

Figure 2.1 Representative Location Layout During Drilling, Vermillion Basin Natural Gas Project, Sweetwater County, Wyoming, 2000 20

Figure 2.2 Typical Parallel Road/Pipeline Cross Section with Width Specifications for the Proposed Road Types, Vermillion Basin Natural Gas Project, Sweetwater County, Wyoming, 2000 22

Figure 2.3 General Stratigraphic Column, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 27

Figure 2.4 Typical Single Well Location Production Facility Schematic, Vermillion Basin Natural Gas Project, Sweetwater County, Wyoming, 2000 32

Figure 3.1 Air Quality Parameters in the Vermillion Basin Region, Sweetwater County, Wyoming, 2000 86

Figure 3.2 Visibility in the Green River Basin, 1997-1998 87

LIST OF TABLES

Page

Table 1.1 Major Federal, State, and Local Permits, Approvals, and Authorizing Actions, Vermillion Basin Natural Gas Project, Sweetwater County, Wyoming, 2000 5

Table 2.1 Types and Approximate Acreages of Existing and Proposed Surface Disturbance, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 15

Table 2.2 Gas Composition from 45 Existing Wells, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 33

Table 2.3 Estimated Workforce Requirements, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 38

LIST OF TABLES (Continued)

Page

Table 2.4 Estimated Traffic Requirements, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 39

Table 2.5 Hazardous and Extremely Hazardous Materials Potentially Utilized or Produced During Construction, Drilling, Production, and Reclamation Operations by the Vermillion Basin Natural Gas Project, Sweetwater County, Wyoming, 2000 45

Table 2.6 Summary of Environmental Consequences and Mitigation Measures, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 . . 81

Table 3.1 Critical Elements of the Human Environment, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 84

Table 3.2 Acreages of Tributary Sub-watersheds Within the Vermillion Watershed, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 98

Table 3.3 Functioning Condition of Streams in the Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 102

Table 3.4 *Wyoming Weed and Pest Control Act* Designated List 108

Table 3.5 Federal Threatened, Endangered, Proposed, and Candidate Species and Their Potential Occurrence on the Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 118

Table 3.6 Grazing Allotment Acreage, Animal Unit Month (AUM) and Category, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 (BLM 2000 Unpublished Data) 135

Table 4.1 Cumulative Impact Assessment Areas, Vermillion Basin Project Area, Sweetwater County, Wyoming 141

Table 4.2 Acreage of New and LOP Disturbance in Sub-watersheds, Vermillion Basin Project Area, Sweetwater County, Wyoming 155

Table 4.3 Existing and Proposed Disturbance in Big Game Ranges, Vermillion Basin Project Area, Sweetwater County, Wyoming 172

LIST OF TABLES (Continued)

Page

Table 4.4 Estimated Annual Income and Tax Revenues Resulting from a One Million Cubic Feet Per Day (1 mmcfd) Stream of Natural Gas, Vermillion Basin Project Area, Sweetwater County, Wyoming 193

Table 4.5 Estimated Income and Tax Revenues for the Proposed Action, Vermillion Basin Project Area, Sweetwater County, Wyoming 193

Table 4.6 Acreage of Proposed and Existing Disturbance in Grazing Allotments, Vermillion Basin Project Area, Sweetwater County, Wyoming 197

Table 5.1 General Record of Persons, Groups, and Governmental Agencies Contacted 207

Table 5.2 List of Preparers 209

ABBREVIATIONS AND ACRONYMS

°F	Degrees Fahrenheit
µg	Micrograms
$\mu g/m^3$	Micrograms per cubic meter
ACEC	Area(s) of Critical Environmental Concern
acre-ft	Acre-foot/feet
APD	Application for Permit to Drill
APLIC	Avian Power Line Interaction Committee
AQD	Air Quality Division
ARPA	*Archaeological Resource Protection Act of 1979*
ATV	All-terrain vehicle
AUM	Animal unit month
BA	Biological Assessment
BACT	Best available control technology
bbl	Barrel
bcpd	Barrels of condensate per day
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
C.F.R.	Code of Federal Regulations
cfs	Cubic feet per second
CIAA	Cumulative impact assessment area
CNHP	Colorado Natural Heritage Program
CO	Carbon monoxide
CO_2	Carbon dioxide
COE	U.S. Army Corps of Engineers
dB	Decibel
dBA	A-weighted decibel
DOT	U.S. Department of Transportation
EA	Environmental assessment
ECRRP	Erosion Control, Revegetation, and Restoration Plan
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
EVG	Erathem-Vanir Geological Consultants
ExPA	Experimental Population Area
FAR	Functioning-at-risk
FLPMA	*Federal Land Policy and Management Act of 1976*
ft	Foot or feet
gal	Gallon
GRRA	Green River Resource Area
H_2S	Hydrogen sulfide

HAP	Hazardous air pollutant
hp	Horsepower
hr	Hour
I-80	Interstate 80
IDT	Interdisciplinary Team
l	liter
LOP	Life-of-project
LQD	Land Quality Division
m	Meter(s)
mcf	Thousand cubic feet
mi	Mile(s)
MLE	Most likely exposure
mmcf	Million cubic feet
mmcfd	Million cubic feet per day
mph	Miles per hour
MSDS	Material Safety Data Sheet
N_2	Nitrogen
NAAQS	National Ambient Air Quality Standards
NCPA	National Cultural Programmatic Agreement
n.d.	No date
NEPA	*National Environmental Policy Act of 1969* (as amended)
NHPA	*National Historic Preservation Act of 1966*
NF	Nonfunctional
NO_x	Oxides of nitrogen
NO_2	Nitrogen dioxide
NOS	Notice of Staking
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NSO	No Surface Occupancy
NTL	Notice to Lessees
Operators	Wexpro Company, Questar Exploration and Production Company, Marathon Oil Company, Basin Exploration, and other natural gas operators
ORV	Off-road vehicle
OSHA	Occupational Safety and Health Administration
PFC	Proper functioning condition
PMMA	Pine Mountain Management Area
PM_{10}	Particulate matter less than 10 microns in effective diameter
ppm	Parts per million
RCRA	*Resource Conservation and Recovery Act of 1976*
RIP	Recovery and Implementation Program for Endangered Fish Species in the Upper Colorado River Basin

RMP	Resource management plan
ROD	Record of Decision
ROW	Right-of-way
RSFO	Rock Springs Field Office
SARA	*Superfund Amendments and Reauthorization Act of 1986*
SCBC	Sweetwater County Board of Commissioners
SHPO	State Historic Preservation Office
SO_2	Sulfur dioxide
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
SRA	Sensitive resource area
SSAS	Special status animal species
SSPS	Special status plant species
SWPPP	Stormwater Pollution Prevention Plan
TDS	Total dissolved solids
TEP&C	Threatened, endangered, proposed, and candidate
THK	THK Associates, Inc.
TPQ	Threshold planning quantity
tpy	Tons per year
TSP	Total suspended particulate matter
U.S.C.	United States Code
USDI	U.S. Department of the Interior
USDOC	U.S. Department of Commerce
USFS	U.S. Department of Agriculture, Forest Service
USFWS	U.S. Fish and Wildlife Service
UW	University of Wyoming
USGS	U.S. Geological Survey
VBPA	Vermillion Basin Project Area
VOC	Volatile organic compounds
VRM	Visual Resource Management
WAAQS	Wyoming Ambient Air Quality Standards
WDAI	Wyoming Department of Administration and Information
WDEA	Wyoming Division of Economic Analysis
WDEQ	Wyoming Department of Environmental Quality
WDOC	Wyoming Department of Commerce
WDOE	Wyoming Department of Employment
WDOT	Wyoming Department of Transportation
WDR	Wyoming Department of Revenue
WGFD	Wyoming Game and Fish Department
WHHMA	Wild Horse Herd Management Area
WNDD	Wyoming Natural Diversity Database
WOGCC	Wyoming Oil and Gas Conservation Commission
WQD	Water Quality Division
W.S.	Wyoming Statute
WSA	Wilderness Study Area

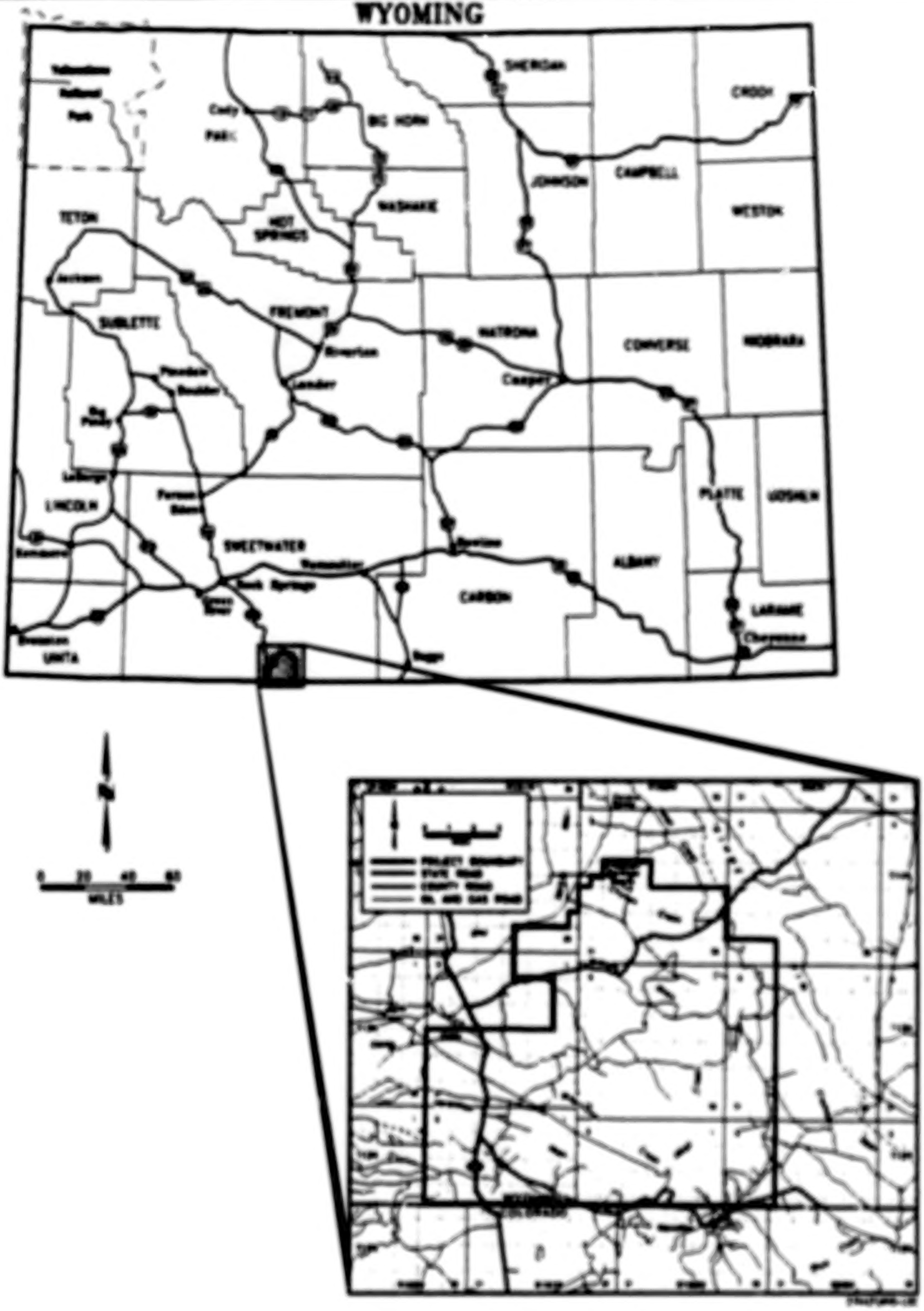
WSEO	Wyoming State Engineer's Office
WSLUC	Wyoming State Land Use Commission
WSLUP	Wyoming State Land Use Plan
WSP	Wyoming State Protocol
WY-430	Wyoming State Highway 430

1.0 INTRODUCTION

Wexpro Company, Questar Exploration and Production Company, Marathon Oil Company, Basin Exploration, and other natural gas operators (collectively known as the Operators) have notified the Bureau of Land Management (BLM), Rock Springs Field Office (RSFO) that they propose to expand natural gas exploration and development of their oil and gas leases in the Vermillion Basin area (Map 1.1). The Vermillion Basin project area (VBPA) encompasses 92,490 acres located approximately 45 miles (mi) southeast of Rock Springs in south-central Sweetwater County, Wyoming (T12-14N, R99-101W), and is within the administrative boundary of the BLM RSFO. The VBPA is accessed via Wyoming State Highway 430 (WY-430), Sweetwater County Roads 4-19 and 4-25, and other existing field access roads. The VBPA has experienced drilling and production since the 1940s in portions of the Canyon Creek, Trail, Pioneer, Kinney, and Kinney Rim Units. One hundred fifty-four wells have been drilled to date. Seventy-two wells having been plugged and abandoned, while 82 wells are currently producing.

The Operators propose to drill up to 56 additional wells in the area, including from three to eight exploratory wells, and from 48 to 53 production wells. Well densities are not anticipated to exceed 16 well locations per section (40-acre spacing). This represents the maximum anticipated development for the project, and assumes that exploration would validate the drilling of this number of wells. Approximately 50% of the proposed wells would be drilled during a 5-year period as production wells within known producing areas, with the balance of the project being dependent upon the success of the exploratory wells.

As many as four exploratory wells may be approved for drilling during the preparation of this environmental assessment (EA). Exploratory drilling proposals would be reviewed on a case-by-case basis and may be allowed if it would not result in: significant environmental impacts; an irreversible or irretrievable commitment of resources; and/or the inability to



Map 1.1 Location of the Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

select an alternative action identified during this analysis process. In addition, reworking of existing wells may be allowed.

Whereas road and pipeline systems are in place to access the field and move gas from the field, approximately 28 mi of new roads with adjacent pipelines would be necessary. In addition, an unknown horsepower (hp) capacity of new on-location and existing-station compression is proposed, as are one or more gravel pits (20 total acres) for road construction/upgrading materials. No new water disposal facilities are proposed. Water for drilling activities is anticipated to be supplied from existing water wells and no new water wells are currently proposed.

1.1 PURPOSE AND NEED

The purpose of the proposed project is the commercial production of federally owned natural gas by private companies pursuant to their rights under existing oil and gas leases issued by the BLM, and to prevent drainage of federal minerals by adjacent wells on non-federal lands. National mineral leasing policies and the regulations by which they are enforced recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands as long as undue and unnecessary environmental degradation is not incurred. Private- and state-owned gas would likely be developed regardless of the development on federal lands.

Natural gas is an integral part of the U.S.'s energy future due to its availability, the presence of an existing market delivery infrastructure, and the environmental advantages of burning natural gas as compared to other fuels. In addition, the development of domestic reserves of clean-burning natural gas would reduce this country's dependence on foreign sources of energy and maintain an adequate and stable supply of fuel for economic well-being, industrial production, and national security. The environmental advantages of burning natural gas are emphasized in the *Clean Air Act* amendments of 1990.

1.2 CONFORMANCE AND AUTHORIZATION ACTIONS

This EA is prepared in accordance with the *National Environmental Policy Act of 1969*, as amended (NEPA), and is in compliance with all applicable regulations and laws passed subsequently, including Council on Environmental Quality (CEQ) regulations (40 *Code of Federal Regulations* [C.F.R.] 1500-1508), U.S. Department of Interior (USDI) requirements (*Department Manual 516, Environmental Quality* [USDI 1980]), guidelines listed in the BLM *NEPA Handbook, H1790-1* (BLM 1988), *and Guidelines for Assessing and Documenting Cumulative Impacts* (BLM 1994). This EA assesses the environmental impacts of the Proposed Action, and No Action Alternative and will serve to guide the decision-making process.

The BLM is the lead agency for the preparation of this EA. Policies for development and land use decisions within this area are contained in the Green River Resource Area (GRRA) Resource Management Plan (RMP) and Environmental Impact Statement (EIS) (BLM 1992, 1996) and the Record of Decision (ROD) (BLM 1997a), and the proposed project would be in accordance with the RMP and ROD and no RMP amendments would be necessary. The GRRA RMP states, "the objective for management of the minerals program is to maintain or enhance opportunities for mineral exploration and development, while protecting other values." The proposed project is also in conformance with the *State of Wyoming Land Use Plan* (Wyoming State Land Use Commission 1979) and the Sweetwater County Land Use Plan (Sweetwater County Board of Commissioners [SCBC] 1996), and would comply with all relevant federal, state, and local laws (Table 1.1).

A tiered approach to environmental review is used by the BLM in the leasing, exploration, and development of mineral resources. Initial environmental review occurs during BLM land use planning, during which the appropriateness of leasing and stipulations for development are identified with public input. Accordingly, the federal minerals within the VBPA that have been leased to the Operators carry a contractual commitment to allow for

Table 1.1 Major Federal, State, and Local Permits, Approvals, and Authorizing Actions, Vermillion Basin Natural Gas Project, Sweetwater County, Wyoming, 2000.[1]

Agency	Permit, Approval, or Action	Authority
Bureau of Land Management (BLM)	Permit to drill, deepen, or plug back on BLM-managed land (Application for Permit to Drill [APD] process)	*Mineral Leasing Act of 1920*, as amended (30 *United States Code* [U.S.C.] 181 et seq.); Requirements for Operating Rights Owners and Operators, as amended (43 *Code of Federal Regulations* [C.F.R.] 3162)
	Rights-of-way (ROW) grants and temporary use permits for pipelines and central tank battery on BLM-managed land	*Mineral Leasing Act of 1920*, as amended (30 U.S.C. 185); Onshore Oil and Gas Unit Agreements: Unproven Areas, as amended (43 C.F.R. 3180)
	ROW grants for access roads on BLM-managed land	*Federal Land Policy and Management Act* (43 U.S.C. 1761-1771); Rights-of-Way, Principles and Procedures, as amended (43 C.F.R. 2800)
	Authorization for flaring and venting of natural gas on BLM-managed land	*Mineral Leasing Act of 1920*, as amended (30 U.S.C. 181 et seq.); Requirements for Operating Rights Owners and Operators, as amended (43 C.F.R. 3162)
	Plugging and abandonment of a well on BLM-managed land	*Mineral Leasing Act of 1920*, as amended (30 U.S.C. 181 et seq.); Requirements for Operating Rights Owners and Operators, as amended (43 C.F.R. 3162)
	Antiquities and cultural resource permits on BLM-managed land	*Antiquities Act of 1906*, as amended (16 U.S.C. 431-433); *Archaeological Resources Protection Act of 1979*, as amended (16 U.S.C. 470aa-470ll); Preservation of American Antiquities, as amended (43 C.F.R. 3)
	Approval to dispose of produced water on BLM-managed land	*Mineral Leasing Act of 1920*, as amended (30 U.S.C. 181 et seq.); Special Provisions, as amended (43 C.F.R. 3164); Onshore Oil and Gas Order No. 7, as amended (58 *Federal Register* 47,354)
Sweetwater County	Mineral extraction permits	County Code
	Construction/use permits	County Code and Zoning Resolution
	Conditional use permits	County Code and Zoning Resolution
	Road use agreements/oversize trip permits	County Code
	County road crossing/access permits	County Code/Engineering Department
	H_2S contingency plan	County Health Department
	Small wastewater permits	County Health Department
	Hazardous material recordation and storage	County Code
	Zone changes	Zoning Resolution
	Filing fees	County Code
	Noxious weed control	County Code

Table 1.1 (Continued)

Agency	Permit, Approval, or Action	Authority
U.S. Army Corps of Engineers (COE)	Section 404 permits and coordination regarding placement of dredged or fill material in area waters and adjacent wetlands	Section 404 of the *Clean Water Act of 1972*, as amended (33 U.S.C. 1344); EPA-administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES), as amended (40 C.F.R. 122); State Program Requirements (40 C.F.R. 123); Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Filled Material, as amended (40 C.F.R. 230)
U.S. Fish and Wildlife Service (USFWS)	Coordination, consultation and impact review on federally listed threatened and endangered (T&E) species	*Fish and Wildlife Coordination Act* (16 U.S.C. 661-666c); Section 7 of the *Endangered Species Act of 1973*, as amended (16 U.S.C. 1536); *Bald Eagle Protection Act* (16 U.S.C. 668-668dd)
	Migratory bird impact coordination	*Migratory Bird Treaty Act* (16 U.S.C. 704)
U.S. Environmental Protection Agency (EPA)	Spill Prevention Control and Countermeasure (SPCC) Plans	Oil Pollution Prevention, as amended (40 C.F.R. 112)
	Regulate hazardous waste treatment, storage, and/or disposal	*Resource Conservation and Recovery Act of 1976*, as amended (42 U.S.C. 6901 et seq.)
U.S. Department of Energy (DOE)	Regulate interstate pipeline product transportation	Various sections of the U.S.C.
U.S. Department of Transportation (DOT)	Control pipeline maintenance and operation	Transportation of Natural and Other Gas by Pipeline; Annual Reports, Incident Reports, and Safety Related Condition Reports, as amended (49 C.F.R. 191); and Transportation of Natural and Other Gas by Pipeline: Minimum Safety Standards, as amended (49 C.F.R. 192)
Wyoming Department of Environmental Quality, Water Quality Division (WDEQ/WQD)	Permits to construct settling ponds and waste water systems, including ground water injection and disposal wells	Wyoming *Environmental Quality Act*, Article 3, Water Quality, as amended (Wyoming Statute [W.S.] 35-11-301 through 35-11-311)
	Regulate disposal of drilling fluids from abandoned reserve pits	Wyoming *Environmental Quality Act*, Article 3, Water Quality, as amended (W.S. 35-11-301 through 35-11-311)
	NPDES permits for discharging waste water and storm water runoff	WDEQ-WQD Rules and Regulations, Chapter 18, Wyoming *Environmental Quality Act*, Article 3, Water Quality, as amended (W.S. 35-11-301 through 35-11-311); Section 405 of the *Federal Water Pollution Control Act (Clean Water Act)* (codified at 33 U.S.C. 1345); EPA-administered Permit Programs: NPDES, as amended (40 C.F.R. 122); State Program Requirements (40 C.F.R. 123); EPA Water Program Procedures for Decision-making, as amended (40 C.F.R. 124)
	Administrative approval for discharge of hydrostatic test water	Wyoming *Environmental Quality Act*, Article 3, Water Quality, as amended (W.S. 35-11-301 through 35-11-311)
Wyoming Department of Environmental Quality, Air Quality Division (WDEQ/AQD)	Permits to construct and permits to operate	*Clean Air Act*, as amended (42 U.S.C. 7401 et seq.); Wyoming *Environmental Quality Act*, Article 2, Air Quality, as amended (W.S. 35-11-201 through 35-11-212)

Table 1.1 (Continued)

Agency	Permit, Approval, or Action	Authority
Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD)	Mine permits, impoundments, and drill hole plugging on state lands	Wyoming *Environmental Quality Act*, Article 4, Land Quality, as amended (W.S. 35-11-401 through 35-11-437)
Wyoming Department of Environmental Quality, Solid Waste Division (WDEQ/SWD)	Construction fill permits and industrial waste facility permits for solid waste disposal during construction and operations	Wyoming *Environmental Quality Act*, Article 5, Solid Waste Management, as amended (W.S. 35-11-501 through 35-11-520)
Wyoming Department of Transportation (WDOT)	Permits for oversize, overlength, and overweight loads	Chapters 17 and 20 of the Wyoming Highway Department Rules and Regulations
	Access permits to state highways	Chapter 13 of the Wyoming Highway Department Rules and Regulations
Wyoming Oil and Gas Conservation Commission (WOGCC)/Wyoming Board of Land Commissioners/Land and Farm Loan Office	Approval of oil and gas leases, ROWs for long-term or permanent off-lease/off-unit roads and pipelines, temporary use permits, and developments on state lands	Public Utilities, W.S. 37-1-101 et seq.
WOGCC	Permit to drill, deepen, or plug back (APD process)	WOGCC Regulations, Chapter 3, Operational and Drilling Rules, Section 2 Location of Wells
	Permit to use earthen pit (reserve pits)	WOGCC Regulations, Chapter 4, Environmental Rules, Including Underground Injection Control Program Rules for Enhanced Recovery and Disposal Projects, Section 1, Pollution and Surface Damage (Forms 14A and 14B)
	Authorization for flaring or venting of gas	WOGCC Regulations, Chapter 3, Operational and Drilling Rules, Section 45 Authorization for Flaring or Venting of Gas
	Permit for Class II underground injection wells	Underground Injection Control Program: Criteria and Standards, as amended (40 *C.F.R.* 146); State Underground Injection Control Program, State-administered program - Class II Wells, as amended (40 *C.F.R.* 147.2551)
	Well plugging and abandonment	WOGCC Regulations, Chapter 3, Section 14, Reporting (Form 4); Section 15, Plugging of Wells, Stratigraphic Tests, Core, or Other Exploratory Holes (Form 4)
	Change in depletion plans	Wyoming *Oil and Gas Act*, as amended (W.S. 30-5-110)
Wyoming State Engineer's Office (WSEO)	Permits to appropriate ground water (use, storage, wells, dewatering)	W.S. 41-3-901 through 41-3-938, as amended (Form U.W. 5)
Wyoming State Historic Preservation Office (SHPO)	Cultural resource protection, programmatic agreements, consultation	Section 106 of *National Historic Preservation Act of 1966*, as amended(16 U.S.C. 470 et seq.) and Advisory Council Regulations on Protection of Historic and Cultural Properties, as amended (36 *C.F.R.* 800)

---

[1] This list is intended to provide an overview of the key regulatory requirements that would govern project implementation. Additional approvals, permits, and authorizing actions may be necessary.

their development in accordance with the terms and conditions of the respective leases. During exploration, site-specific EAs are prepared to ensure that significant impacts to surface and subsurface resource values do not occur. Site-specific EAs would be prepared for each *Application for Permit to Drill* (APD) and each right-of-way (ROW) application for access roads, pipelines, etc., as these applications are submitted.

Although the BLM has the authority to deny individual APDs and ROW applications, the lessees' right to drill and develop cannot be denied. Pursuant to the *Federal Land Policy and Management Act of 1976* (FLPMA), the BLM also has the authority and responsibility to protect the environment within federal oil and gas leases; therefore, restrictions may be imposed on lease terms. However, mitigation measures that would render a proposed operation uneconomic or unfeasible are not consistent with the lessee's rights and cannot be required unless they are included as a lease stipulation or are necessary to prevent unnecessary and undue degradation of public lands or resources (43 C.F.R. 3101.1-2).

This EA will provide a resource-specific analysis of the impacts associated with the Proposed Action to determine whether any significant impacts would likely occur that would require the preparation of an EIS.

1.3 LAND AND RESOURCE MANAGEMENT ISSUES AND CONCERNS

Pursuant to NEPA and CEQ regulations, the BLM conducted internal and public scoping processes in December 1999 and January 2000 and received 20 comment letters. The following land and resource management issues and concerns associated with the Proposed Action were identified during scoping for consideration during the preparation of this EA.

Transportation

- Impacts, structural condition, weight limits to (WY-430).
- Impacts of field access roads (construction, placement of culverts, surfacing, maintenance, prevention of erosion).
- Impacts of drainage and sedimentation to downstream waters.
- Long-term maintenance of road system (transportation planning).
- Road densities.

Water Quality/Surface Water

- Maintaining/improving water quality.
- Sedimentation and salinity to downstream waters.
- Water depletion from the Upper Colorado River system.
- Impacts to Chicken Springs, other springs and seeps, and Alkali, Coyote, and Vermillion Creeks and associated riparian areas and flood plains.
- Section 404 permits.
- Non-point source water quality impacts.

Wildlife

- Impacts to big game winter ranges and winter use.
- Impacts to antelope crucial winter range (Bitter Creek and South Rock Springs herds).
- Displacement of and direct mortality to big game species, including that caused by vehicles and poaching.
- Impacts to raptor nests and raptor mortality from power lines.
- Impacts to sage grouse lek/breeding, nesting, and winter habitats, including disruption of lek activities caused by noise.
- Impacts to sage grouse from new power lines that could be used as hunting perches by raptors.

- Importance of industry-financed annual monitoring of sage grouse and raptor nests to detect impacts and identify mitigation needs.
- Impacts to prairie dogs.
- Impacts to the black-footed ferret reintroduction area located south of VBPA.
- Impacts to mountain plover.
- Impacts to U.S. Fish and Wildlife Service (USFWS)-listed species (threatened, endangered, proposed, and candidate [TEP&C] species), including Colorado River endangered fish species.
- Protection of brook trout and other fish species, including Colorado River cutthroat trout (petitioned to be listed as threatened under the *Endangered Species Act*).
- Mitigation for short-term and long-term wildlife habitat impacts.
- Adequacy of baseline wildlife data.
- Adequate and timely monitoring of impacts of gas development on wildlife.
- Impacts to winter range of all species.

Range/Vegetation/Soils

- Impacts to carrying capacity (decrease in vegetation cover, distribution of surface disturbance).
- Short- and long-term effects of disturbance.
- Short- and long-term erosion effects.
- Impacts to steep slopes.
- Impacts due to poorly developed soils.
- Invasive, non-native plant species.
- Reclamation of disturbed areas (standards and timing).
- Impacts to livestock grazing.

Paleontology

- Impacts to paleontological resources.

Air Quality

- Impacts to air quality from field emissions.
- Global warming.

Cultural/Historic Resources

- Impacts to Cherokee Trail segments.
- Historic development of oil/gas within the basin.
- Impacts to other historic and archaeological resources.

Pine Mountain Management Area

- Effects of disturbance restrictions and criteria.

Socioeconomics/Land Use

- Impacts on recreation.
- Economic impacts.
- Tax revenue generation.

Cumulative Impacts

- Cumulative impacts to all affected resources.

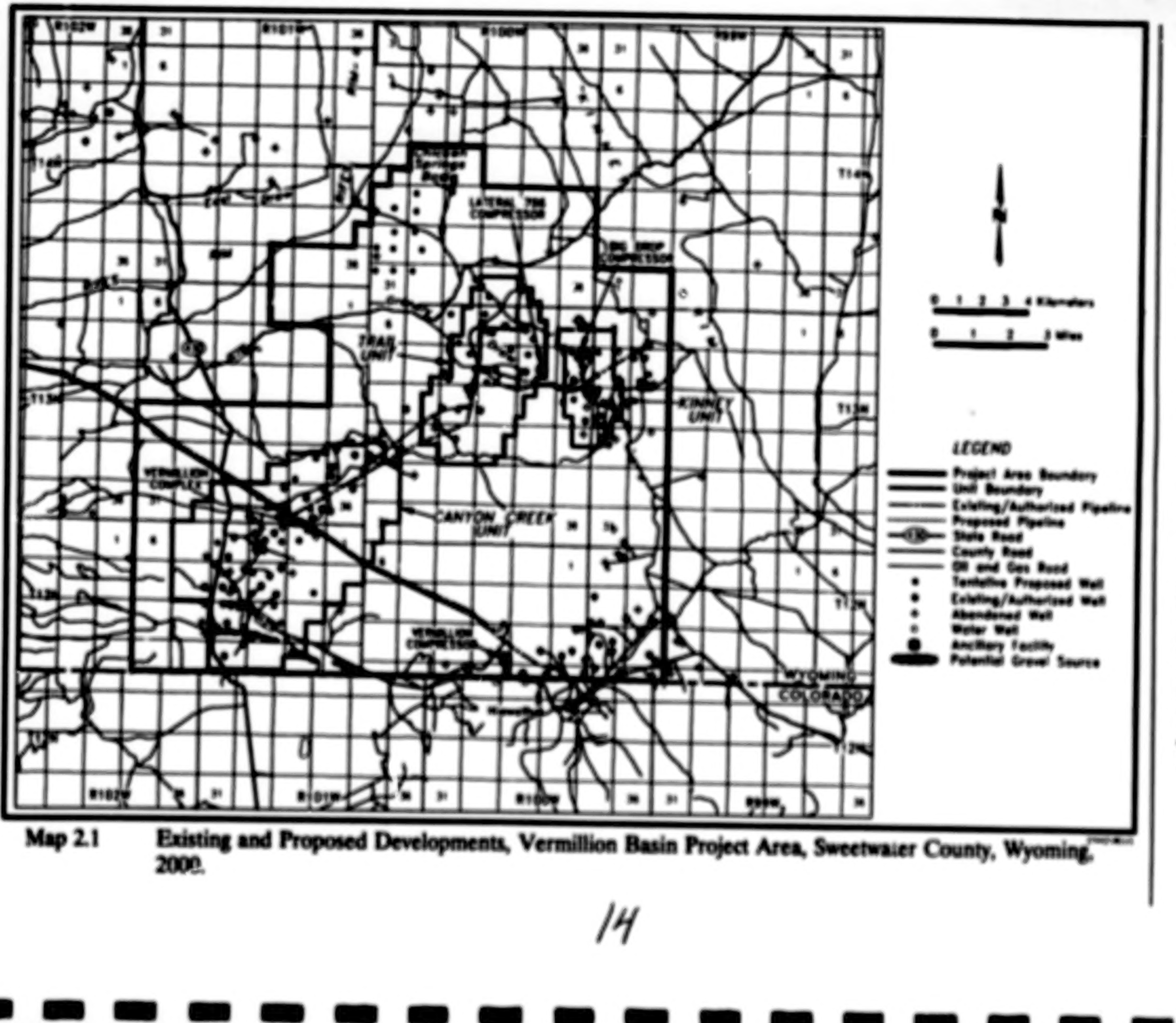
Miscellaneous

- Conformance with all necessary federal, state, and local laws, rules, and regulations, and associated permit acquisition.
- Access to state minerals, particularly under federal surface.
- Conformance with Salt Wells Wild Horse Herd Management Area (WHHMA).
- Possibility of directional drilling.

2.0 THE PROPOSED ACTION AND NO ACTION ALTERNATIVE

Two alternatives are evaluated in this EA: 1) the Proposed Action (56 wells on 56 locations) (Section 2.1); and 2) the No Action Alternative (Section 2.2). Additional alternatives were considered but rejected, and are discussed in Section 2.3. The project entails the continuation of exploration for and development of natural gas resources in the VBPA over the next 10-20 years, with production for up to 50 years (i.e., a 50-year life-of-project [LOP]). Wells would be drilled at densities of one to 16 wells per section (640- to 40-acre spacing). As areas of the VBPA are developed and more is learned about the natural gas resources in the field, Wyoming Oil and Gas Conservation Commission (WOGCC)-specified spacing orders for the area could change.

The VBPA encompasses 92,490 acres located approximately 45 mi southeast of Rock Springs in south-central Sweetwater County, Wyoming (T12-14N, R99-101W), and is within the administrative boundary of the BLM RSFO. The VBPA includes 85,610 acres (92.6%) of federal surface and minerals; 4,840 acres (5.2%) of State of Wyoming surface and minerals; 640 acres (0.7%) of federal surface and State of Wyoming minerals; 640 acres (0.7%) of State of Wyoming surface and federal minerals; and 760 acres (0.8%) of private surface and minerals. Access to the VBPA is via WY-430, Sweetwater County Roads 4-19 and 4-25, and other existing field access roads. The VBPA has experienced drilling and production since the 1940s in portions of the Canyon Creek, Pioneer Trail, and Kinney Rim Units. One hundred fifty-four wells have been drilled to date, 72 of which have been plugged and abandoned, leaving 82 currently producing wells. The types and extent of existing and proposed surface disturbance in the VBPA are presented in Map 2.1, and Table 2.1 lists the estimated surface disturbance as a result of existing and proposed developments.



Map 2.1 Existing and Proposed Developments, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

Table 2.1 Types and Approximate Acreages of Existing and Proposed Surface Disturbance, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

Disturbance Type	Existing[1] (acres)	Proposed Action[2] New[4] (acres)	Proposed Action[2] LOP[5] (acres)	No Action Long-term[3] (acres)
Well locations	328	213	56	328
Oil and gas roads	532	187	109	532
Pipelines[6]	0	85	0	0
Ancillary facilities[7]	23	20	0	23
Other developments[8]	222	0	0	222
Subtotal	1,105	505	165	1,105
Existing[9]	N/A	883	883	N/A
Total	1,105	1,388	1,048	1,105

[1] Includes disturbance from all existing well locations (154 total, 82 producing, 4 acres/producing location), oil and gas roads (137.2 mi, 32-ft disturbance width), ancillary facilities (four facilities and four water wells), and other developments (25.8 mi of state and county roads) present in the VBPA (see Map 2.1).

[2] Assumes surface disturbance from 56 new well locations, 28 mi of new/upgraded road (0.5 mi average per well, 55-ft ROW maximum), 28 mi of new pipelines (0.5 mi average per well, 50-ft ROW, [25-ft disturbance outside road ROWs]), new ancillary facilities (gravel pit), and existing project-required disturbances (i.e., 82 well locations, 137.2 mi of oil and gas roads, and 23 acres for ancillary facilities).

[3] Assumes no new disturbance would occur, and includes all existing VBPA disturbances.

[4] Assumes new disturbance of approximately 3.8 acres at well locations, the entire 55-ft ROW for roads, the 25 ft of pipeline ROWs outside of road ROWs, the entire acreage required for ancillary facilities, and all existing disturbance required for the proposed project (see footnote 9).

[5] Assumes adequate reclamation of 2.8 acres at each new well location (1.0-acre LOP disturbance per well location), 23 ft of all new road ROWs (32-ft LOP disturbance width), the entire 25 ft of new pipeline ROWs outside of road ROWs, and all disturbance from new ancillary facilities. Existing disturbance from active well locations, oil and gas roads, and ancillary facilities are included since they would likely be used for the proposed project (see footnote 9).

[6] Assumes 25 ft of pipeline ROWs would be within road ROWs, and all new and existing pipeline ROWs would be adequately reclaimed within the first few years following construction.

[7] Includes all existing (four facilities [21.0 acres] and four water wells [2.0 acres] [total = 23 acres existing disturbance]) and proposed (20 acres for gravel pits) ancillary facility disturbance.

[8] Includes all existing disturbance from other developments in the VBPA not considered part of the proposed project (i.e., state [100-ft width] and county [60-ft width] roads).

[9] Includes all existing disturbance (1,105 acres) less other developments not considered part of the proposed project (222 acres).

2.1 THE PROPOSED ACTION

The Operators propose to drill up to 56 additional wells in the VBPA, including from three to eight exploratory wells and from 48 to 53 production wells, and well densities are not anticipated to exceed 16 well locations per section (40-acre spacing). This represents the maximum development for the project, and assumes that exploration would validate the drilling of this number of wells. Approximately 50% of the proposed wells would be drilled during a 5-year period as production wells within known producing areas, with the balance of the project being dependent upon the success of the exploratory wells.

As many as four exploratory wells may be approved for drilling during the preparation of this EA. Exploratory drilling proposals would be reviewed on a case-by-case basis and may be allowed if it would not result in: significant environmental impacts; an irreversible or irretrievable commitment of resources; and/or the inability to select an alternative action identified during this EA analysis process. In addition, reworking of existing wells may be allowed.

Drilling and development would continue for approximately 10-20 years, with an LOP of approximately 50 years. Development would occur at a rate of from two to six wells per year.

The Proposed Action would result in a maximum of 213 acres of new surface disturbance from well locations (3.8 acres/location [including on-site gathering, compression, measurement, and dehydration facilities]); 28 mi (55-ft wide maximum disturbance area, 187 acres of total disturbance) of new roads (averaging 0.5 mi/location); and 28 mi of new gathering system pipeline (averaging 0.5 mi/location, 25-ft wide disturbance area outside road ROWs, 85 acres of total disturbance) (see Table 2.1). LOP disturbance would be approximately 56 and 109 acres for well locations and roads, respectively. It is assumed that all pipeline ROWs would be adequately reclaimed for the LOP. In addition, one or more gravel pits, estimated to total approximately 20 acres, would also be necessary to provide road surfacing materials for new and upgraded roads. Total new and LOP surface disturbance resulting from the Proposed Action would be 505 acres and 165 acres, respectively (approximately 0.5% and 0.2% of the VBPA, respectively). Existing disturbance on the VBPA includes an estimated total of 1,105 acres: 328 acres from active well locations (assumes 4.0 acres/location); 532 acres from oil and gas roads (137.2 mi); 23 acres from four ancillary facilities (Lateral 706 Compressor, Big Drop Compressor, Canyon Creek-Vermillion Complex, and Vermillion Compressor) and four water wells and 222 acres from other existing nonproject-related disturbance (see Map 2.1). With the inclusion of existing disturbance necessary for the proposed project, total new and LOP surface disturbance would be 1,388 acres and 1,048 acres, respectively (approximately 1.5% and 1.1% of the VBPA, respectively).

Construction, operation, and reclamation of well locations, access roads, pipelines, and all other surface-disturbing activities would comply with BLM mitigation guidelines and best management practices. Road construction would adhere to specifications in the BLM Roads Standards Manual, Section 9113 (BLM 1985, 1991a).

Operators would follow the procedures outlined below to obtain BLM approval for proposed activities on federal lands within the VBPA. Permitting procedures on State of Wyoming and private lands would adhere to WOGCC rules and regulations (WOGCC 1998) and be subject to individual landowner preferences for development, operation, and reclamation practices. This EA provides specific details for development on lands with federal surface and mineral estates.

Developments on private and state lands are also assessed; however, since the BLM has very limited authority to regulate activities on these lands, procedural modifications including alternative construction, operation, mitigation, and reclamation methodologies could occur.

2.1.1 Pre-construction Activities

Prior to the start of construction activities, Operators would submit a Notice of Staking (NOS), APD, Sundry Notice, and/or ROW application to the BLM with a map showing the specific location of the proposed activity (e.g., specific well location, road or pipeline route, or other facility site), as well as site-specific construction plans. Proposed development sites would be staked by the applicant and inspected by the BLM to ensure consistency with the application. A site-specific EA would be prepared to ensure all site-specific resources are evaluated and proposed operations comply with RMP and EA decisions. Applications would be revised as necessary per negotiations with the BLM. The BLM would either deny or approve specific proposals and attach terms and conditions of approval to the permit. Upon receipt of BLM approval, the applicant could initiate proposed activities.

Design, construction, operation, and reclamation practices may be modified by the Operators and/or the BLM as more site-specific economic, engineering, and environmental information becomes available. Site-specific development plans, including NEPA-mandated environmental analyses on all APDs, ROW applications, and Sundry Notices would be prepared for each proposed well, road, or pipeline constructed on federal land. Pursuant to Onshore Oil and Gas Order Nos. 1 and 2, each proposed well on federal land would require BLM approval of an APD prior to any surface disturbance. Each APD would include site-specific information regarding all facets of well development, including mitigation measures required to minimize adverse environmental impacts. Roads and pipelines on BLM lands constructed in association with this project would require BLM ROW authorizations and/or Sundry Notices which could include additional mitigation to further minimize environmental impacts. Wells proposed on private and state lands would require approval by the WOGCC, whereas roads, pipelines, and/or ancillary facilities on these lands would require private landowner or state approval prior to construction.

Although project components presented in this EA may undergo revision during agency reviews of individual APDs and ROW applications, these revisions would not substantially alter acreage requirements or general reclamation practices and would therefore be consistent with the environmental analysis presented in this EA. In addition, more detailed site-specific analysis would be required prior to development activities, and any changes would be addressed in subsequent analyses.

2.1.2 Construction and Drilling

2.1.2.1 Well Pad Construction

The typical well pad would disturb approximately 3.8 acres during drilling operations (Figure 2.1). Components of the well pad include an unlined earthen reserve pit to contain drilling fluids, cuttings, and water produced during drilling and a flare pit to be used during testing. All reserve pits would be constructed per BLM and/or WOGCC requirements to protect surface and ground water resources. Site-specific analyses conducted by the BLM during the APD process would determine whether reserve pits would be lined with a synthetic liner.

Well locations would be cleared of vegetation and topsoil (up to 12 inches), which would be stockpiled together for future use in reclamation. The well location would be leveled using standard cut-and-fill construction techniques. At locations where minimal cut-and-fill construction is needed and/or where topsoil is saline and/or alkaline and its removal could create depressions capable of retaining water, the topsoil would be stripped only from the pit and spoil stockpile areas to facilitate future reclamation. In areas of rough terrain or where significant erosion/construction hazards exist, detailed engineering designs would be developed by a licensed professional engineer and construction would be monitored as determined by the BLM.

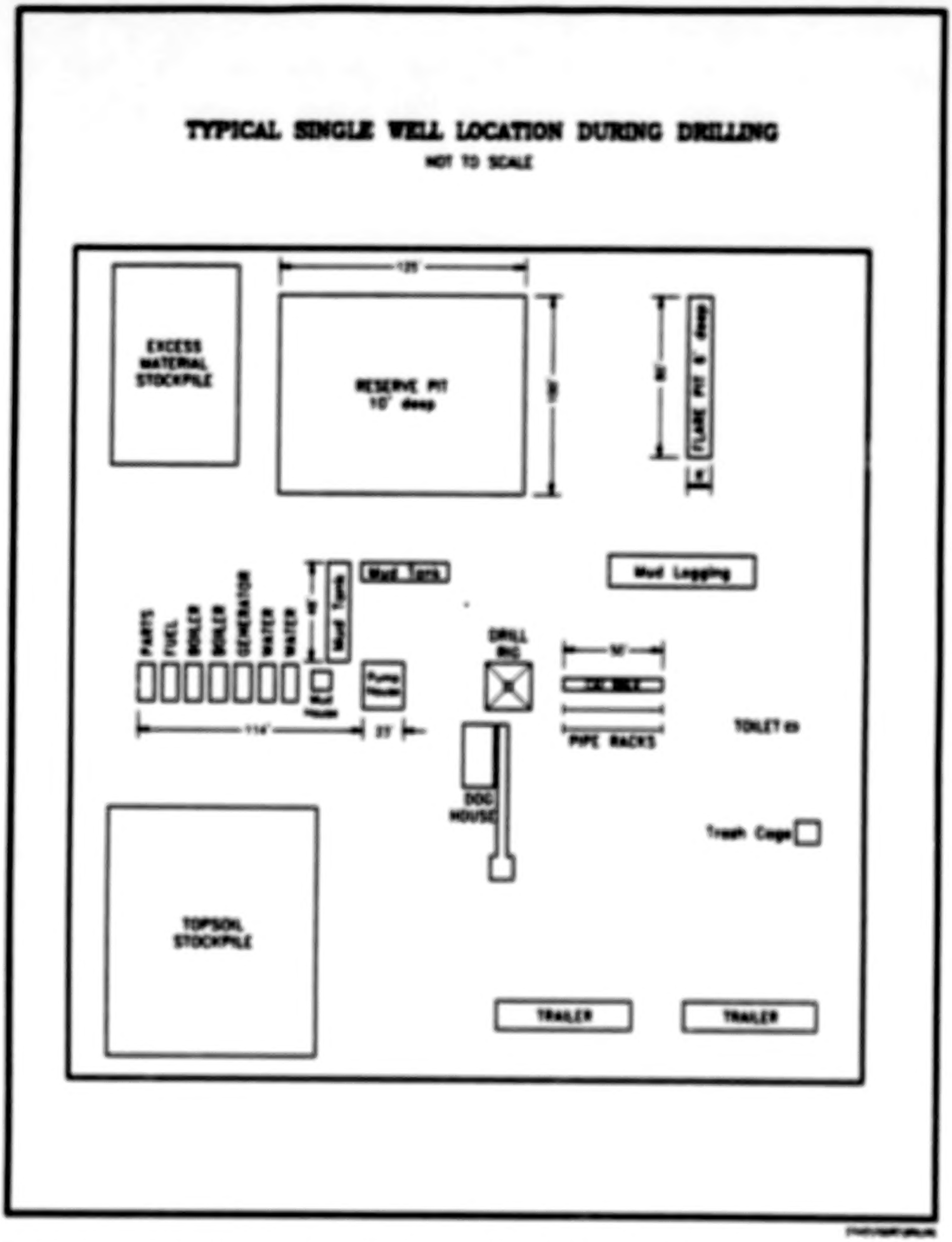


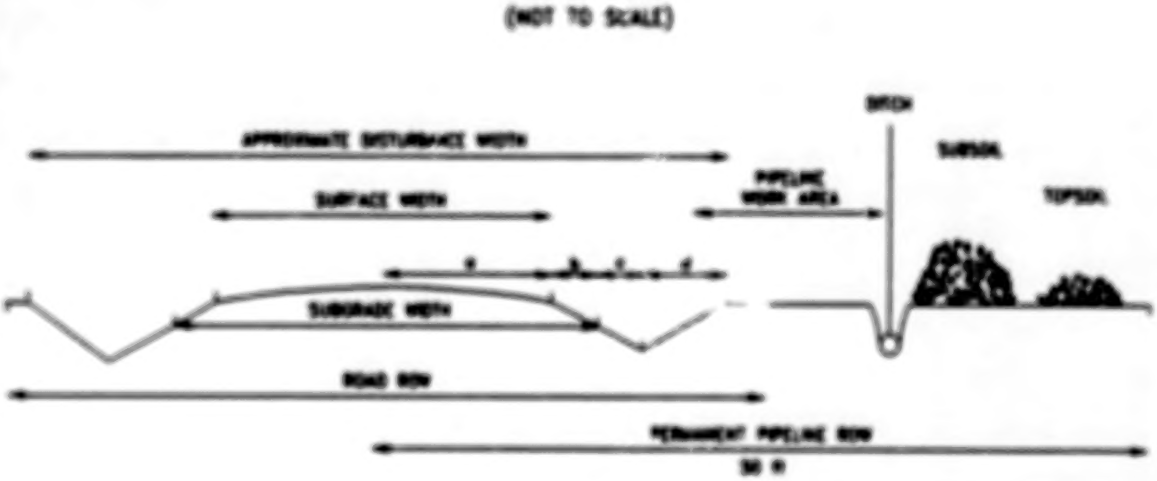
Figure 2.1 Representative Location Layout During Drilling, Vermillion Basin Natural Gas Project, Sweetwater County, Wyoming, 2000.

Erosion would be controlled with prompt revegetation and by constructing surface water drainage controls such as berms, diversion ditches, and sediment ponds as necessary at each well location. Stormwater Pollution Prevention Plans (SWPPPs) would be prepared for all well locations, access roads, and other development sites that disturb more than 5 acres. In some cases, SWPPPs may be prepared for groups of 20 or more wells.

2.1.2.2 Road Construction

The exact locations of proposed roads within the VBPA cannot be predicted at this time because they depend on the locations of wells; however, specific access road construction would be in accordance with the BLM-approved guidelines (BLM 1985, 1991a). New roads would be located to minimize disturbance, utilize existing disturbed areas such as two-track routes and pipeline corridors, avoid sensitive resources such as raptor nests and cultural resource sites, and maximize transportation efficiency. For this project, it is estimated that 0.5 mi of new or upgraded road would be required to access each well location. Operators may petition the Sweetwater County Road and Bridge Department to assist in county road improvement work.

Existing and proposed roads within the VBPA can be divided into functional classifications based on BLM Manual Section 9113 (BLM 1985, 1991a) and Federal Highway Administration classifications (U.S. Department of Transportation [DOT] Federal Highway Administration 1992). Figure 2.2 illustrates a typical road cross section with a parallel pipeline ROW. Surface disturbance would be contained within approved ROWs and would average 52 ft for collector roads (60-ft ROW), 48 ft for local roads (55-ft ROW), and 42 ft for resource roads (50-ft ROW). Disturbance width may increase in areas of rugged topography due to the necessity for cuts and fills. Because the exact location and length of collector, local, and resource roads cannot currently be determined, all roads are considered local roads for the purpose of this analysis, and since roads and pipelines would run parallel to each other where practical, the entire road ROW is assumed to be disturbed at some



	MINIMUM SUBGRADE WIDTH (ft)	MINIMUM SURFACED TRAVELWAY WIDTH (ft)	a (ft)	b (ft)	c (ft)	d (ft)	APPROXIMATE DISTURBANCE WIDTH (ft)	ROW WIDTH (ft)	DESIGN SPEED (mph)
RESOURCE ROAD	18	14	7	2	4	8	42	50	15–30
LOCAL ROAD	24	20	10	2	4	8	48	55	20–50
COLLECTOR ROAD	28	24	12	2	4	8	52	60	30–50
ARTERIAL ROAD	SPECIFICATIONS WOULD BE AS REQUIRED BY STATE AND/OR COUNTY OFFICES								

DIAGRAM OF TYPICAL TURNOUTS ON RESOURCE ROADS

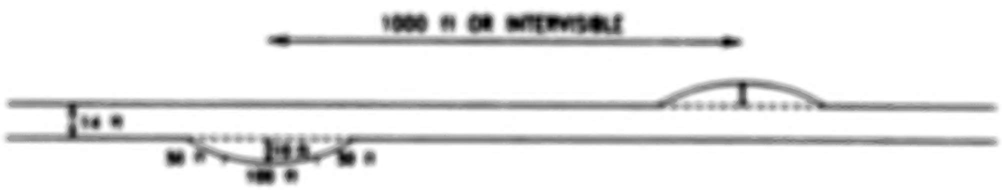


Figure 2.2 Typical Parallel Road/Pipeline Cross Section with Width Specifications for the Proposed Road Types, Vermillion Basin Natural Gas Project, Sweetwater County, Wyoming, 2000.

time during project construction (i.e., 55-ft ROW with 6.7 acres of new surface disturbance per road mile). Some gathering system pipelines may be run on the surface and may be located away from roads (see Section 2.1.5).

Roads would be classified into the following types.

Arterial Roads (Public Roads). Arterial roads serve large areas and within the VBPA they include WY-430 and Sweetwater County Roads 4-19 and 4-25. These public roads connect developed areas of the VBPA to Interstate 80 (I-80) and regional communities. These roads can be considered all-weather roads, and their use is controlled by the Wyoming Department of Transportation (WDOT) or Sweetwater County. Arterial roads are double-lane roads with shoulders and are designed and constructed according to applicable state or county standards.

Collector Roads (Management Roads). Collector roads serve smaller areas than arterial roads and may be divided into major and minor categories. Collectors channel moderate to heavy traffic to and from the arterial system. Major collector roads are often BLM roads that are not a permanent part of the BLM road system, but are managed by BLM. Minor collector roads are developed roads with authorized ROWs issued by private landowners, BLM, or other land managers. These roads may include public-use rights or use may be at the discretion of the landowners and agencies. Portions of minor collector roads may have specific enforceable access restrictions.

Collector road maintenance objectives include the maintenance and improvement of drainage, road surfacing, and road grading to a smooth compact surface. Such roads would be double-lane roads 24 ft wide after surfacing with 4:1 ditches a minimum of 1 ft deep. They would have a gravel surface designed to support highway loads and provide a smooth compact road surface without washboarding. Dust control may be required to retain the fines in the gravel. Collector roads generally would be designed for a minimum travel speed of 35 miles per hour (mph).

Local Roads (Management Roads). Local roads normally serve smaller areas than collector roads, channeling light to moderate traffic to a collector or arterial system. Local roads may support very heavy off-highway loads. Authorization for use of local roads is at the discretion of the landowner or agencies. Local roads within the VBPA would serve specific groups of wells or support facilities, and may become a permanent part of the total road system. Maintenance objectives would include maintaining drainage, surfacing selected segments, or road surface grading.

Local roads would be either double-lane (20-24 ft wide after surfacing) or single-lane (14-16 ft wide after surfacing) with turnouts and would have 4:1 ditches a minimum of 1 ft deep. Gravel surfaces would be designed to support heavy loads. Depending on the length of the road, smoothness of the surface may be less important than the ability of the surface to support heavy loads. Local roads would be designed for speeds of 20-30 mph.

Resource Roads (Management Roads). Resource roads would serve a specific destination and connect to local, collector, or arterial roads. They may dead-end at single well/service facilities or serve small numbers of wells or facilities. Depending on the level of activity, a resource road could serve light traffic and/or very heavy loads. Authorization and use of resource roads are at the discretion of the landowner or agencies. The maintenance objectives for resource roads would be to minimize resource damage, and a resource road would be abandoned and reclaimed when the road is no longer needed. Occasionally, a resource road may be stabilized and allowed to revert to a two-track trail.

Resource roads generally would be single lane roads with turnouts (14-16 ft wide after surfacing) with 4:1 ditches a minimum of 1 ft deep. Gravel, if needed, would be of sufficient quality to support heavy loads for short durations. The surface of a resource road is not required to be smooth. Resource roads would be designed for speeds of 15-30 mph.

Roads across federal lands may be designed by a licensed professional engineer, as deemed appropriate by the BLM, and all roads would be constructed with adequate drainage and erosion control structures (e.g., relief culverts, drainage culverts, wing ditches, water bars). To further decrease potential impacts, the number and miles of roads would be limited by discouraging development of looped roads and by accessing well locations from short spurs off existing, local, collector, and/or arterial roads, where practical. Roads would be closed and reclaimed by the Operators when they are no longer required for the project unless otherwise directed by the BLM.

All newly constructed collector and local roads in the VBPA would be appropriately surfaced (e.g., gravel/aggregate) immediately following construction, and some existing roads may be resurfaced as directed by the BLM. Resource roads to exploratory well sites would be surfaced only after the well has been determined to be productive, unless otherwise directed by the BLM. Approximately 71,000 yds^3 of gravel/aggregates would be used for road and well location construction and these materials would be acquired from suitable areas on federal, state, and private lands on and possibly adjacent to the VBPA (see Map 2.1). Prior to aggregate extraction, appropriate permits would be obtained from the Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD) and federal agencies as necessary. Site-specific NEPA documents would be required for gravel/aggregate extraction operations on federal lands.

Available topsoil would be removed during road construction and placed on the backslope area of borrow ditches within road ROWs. Topsoil would be respread on approximately 11.5 ft of both sides of all roads and reseeded as soon as possible. The entire road ROW to unproductive wells and the entire unproductive well location would be reclaimed as soon as practical, and reclamation activities would normally be completed within 2 years using stockpiled topsoil and BLM-approved seeding techniques. All newly developed roads required for the LOP would be reclaimed upon project abandonment unless otherwise directed by the BLM in consultation with private landowners, county agencies, and other entities as necessary.

2.1.2.3 Drilling Operations

Following access road and well pad construction, a rotary drilling rig would be moved to the location and erected on-site. Rig transport and on-site assembly would be completed in approximately 4 days.

An estimated maximum of five drilling rigs rated to accommodate anticipated final well depths of approximately 1,500 to 15,000 ft would be utilized; however, some wells may be drilled to depths greater than 15,000 ft. All drilling operations and other well-site activities would be conducted in compliance with applicable BLM, WOGCC, WDEQ, and other relevant federal, state, and county rules and regulations (see Table 1.1). Most deep wells would extract resources primarily from the Frontier, Dakota, Entrada, and Nugget Formations; most medium depth wells (i.e., 5,000-8,000 ft) would be completed in the Mesa Verde Group (Almond Formation); and shallow wells less than 5,000 ft deep would likely extract resources from the Wasatch, Fort Union, Lance, and Lewis Formations (Figure 2.3). Drilling would occur commensurate with new discoveries coupled with anticipated development costs and gas prices. Drilling each well would average approximately 20 days for shallow wells and 120 days for deep wells.

Fresh water would be used for drilling the first 5,000 to 8,000 ft of each well, and water-based muds would be used for the remainder of the drilling operation. Drilling muds, cuttings, and water would be stored in the reserve pit (see Figure 2.1). The reserve pit would be fenced on the three nonworking sides during drilling, and within 24 hrs after drilling is completed and the rig substructure is removed, the fourth side would be fenced

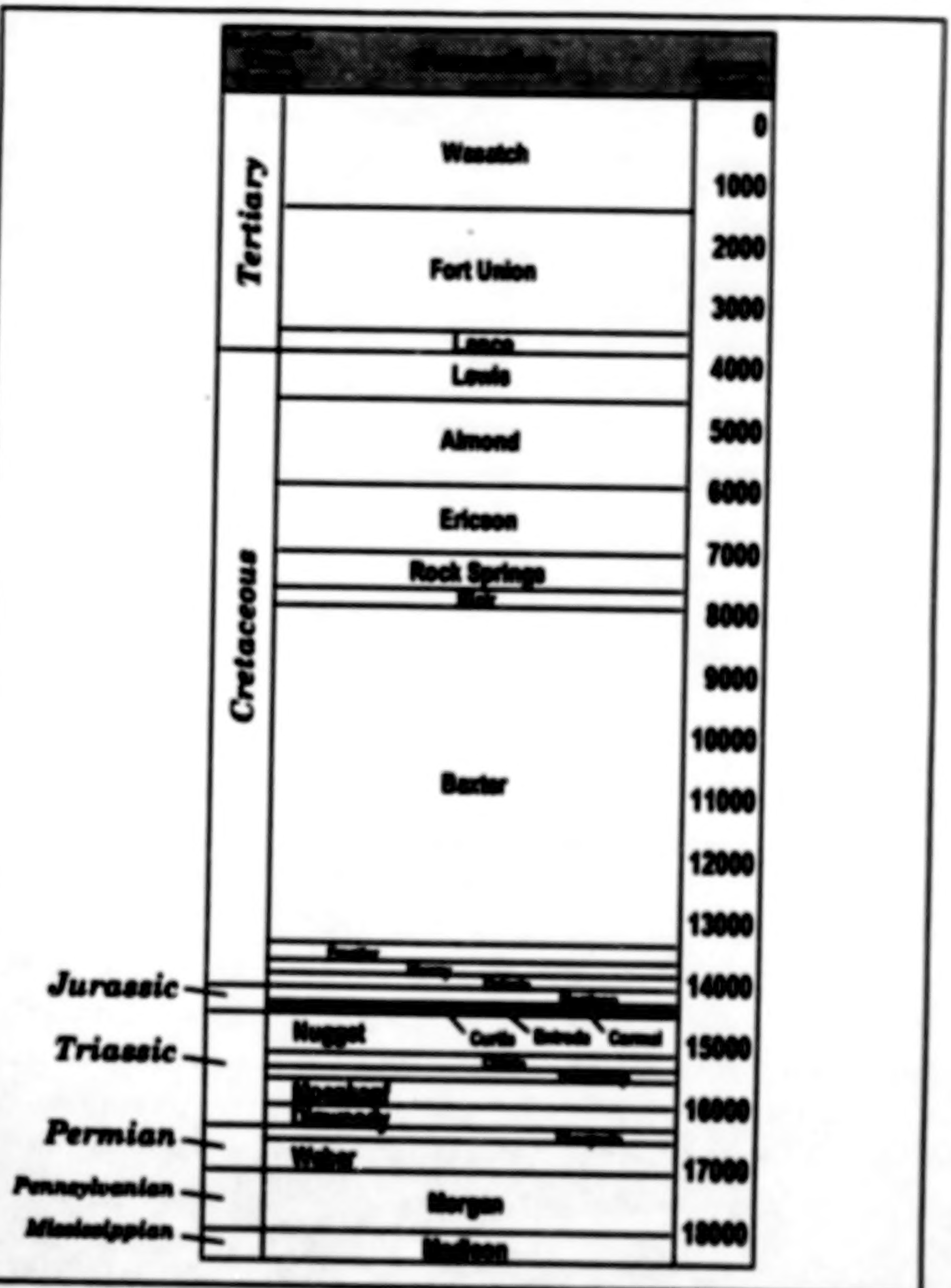


Figure 2.3 General Stratigraphic Column, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

to protect wildlife and livestock until the pit is reclaimed. Reserve pits would be lined to protect surface and ground water resources if so directed by the BLM and/or WOGCC during the APD process. In compliance with BLM Informational Bulletin No. WY-93-054, reserve pits containing oil or other potentially hazardous substances would be protected from access by wildlife.

An approximate maximum 1,050,000 gallons (gal) of water (25,000 42-gal barrels [bbl], 3.2 acre-ft) would be used during the drilling of each well. Water for drilling activities would be supplied from existing water supply wells (690-2,544 ft deep) located in the Kinney and Canyon Creek Fields within or immediately adjacent to the VBPA (see Map 2.1). No new water wells are anticipated for the Proposed Action. Water would be trucked or piped to individual well locations, depending upon site-specific conditions, disturbance requirements, and time of year. Water pipelines would be temporary and would consist of either standard 3- to 6-inch diameter aluminum sections or polypipe which would be laid on the surface and would be removed upon completion of drilling and completion/testing operations.

When the reserve pit is no longer required, fluids within the pit would be withdrawn for use in drilling new wells or allowed to evaporate; however, in some instances, pit contents may be mixed with suitable solid materials and the pit backfilled, as approved by the BLM on federal lands or other entity on non-federal lands. Prior to the mixing of reserve pit contents with approved stabilizing materials, appropriate closure permits would be obtained from the WOGCC and/or WDEQ. If necessary, reserve pit contents would be removed and disposed of at an approved disposal facility in a manner commensurate with all relevant county, state, and federal regulations and stipulations. The reserve pit area would be recontoured and reseeded as soon as possible, but no later than 2 years after completion of drilling and testing operations.

Human waste generated at well locations would be collected in standard portable chemical toilets or service trailers and regularly transported off-site to a county- and state-approved disposal site (e.g., Rock Springs wastewater treatment plant) or otherwise collected and disposed of as authorized by WDEQ. Each well location would be provided with one or more such facilities during drilling and completion operations lasting more than 3 days. A septic system would not be required. Nonhuman waste would be collected in enclosed containers and disposed of at state-approved sites (e.g., Rock Springs Land Fill).

2.1.3 Well Completion and Testing

Well completion and testing operations entail:

- isolating near-surface fresh water aquifers with surface casing set at the start of drilling operations;
- casing and cementing various segments of the wellbore to protect useable water aquifers by running steel pipe into the open borehole and cementing the pipe into place;
- perforating the casing adjacent to the target formation;
- fracture stimulating (fracturing) the target formation when necessary; and
- conducting postfracturing flow tests and cleanup.

Once drilling has been completed, the well would be logged and production casing set to prevent condensates, gas, and/or water movement from reservoir to reservoir and to isolate producing zones, thereby protecting all other zones penetrated by the well. Casing also prevents drill hole cave-in, confines production to the wellbore, and provides a means of controlling pressure to facilitate installation of surface and subsurface well equipment. All well casing and cementing operations on federal minerals would be conducted as directed by the BLM in compliance with BLM Onshore Oil and Gas Order No. 2. Well casing and cementing on state and patented minerals would be as directed by the WOGCC. Casing designs would be provided with each APD to the RSFO.

When casing and cementing have been completed, the well casing would be perforated in the producing formation to allow the flow of hydrocarbons to the wellbore. Many completions in the VBPA would involve inserting a string of tubing into the casing to the top of the perforated productive zone to allow gas, condensate, and water to flow to the surface where it is collected, measured, contained, and transported.

After perforation, the well would be flowed for 1-15 days to evaluate well performance. During testing, flows from the well--including gas and minor amounts of hydrocarbon liquids (condensates)--would be flared to the flare pit pursuant to BLM and/or WOGCC rules and regulations (NTL-4A). Depending on the rates of these flow tests, the formation would be further evaluated for fracture stimulation. Flaring would also occur during flowback operations following fracturing.

Hydraulic fracturing would be performed on many wells to increase gas flow rates by increasing the relative formation permeability. Nitrogen (N_2) or carbon dioxide (CO_2), water-based fluids, and proppants (e.g., granular materials such as sand) are pumped down the wellbore under high pressure and through perforations in the casing into the target formation. The pressurized liquids induce hydraulic fractures in the formation and, when the pressure is released, liquids return to the surface and the fractures partially close on the proppants, leaving channels for gas and liquids to flow into the wellbore. Fracturing liquids returned to the surface would be captured in temporary storage tanks or BLM-approved earthen pits. Liquids would either be evaporated on-site, hauled away from the location for reuse, or disposed of at an authorized facility. Decisions regarding the appropriate handling of fracturing liquids would be made by the BLM and/or WOGCC on a case-by-case basis.

Approximately 55,000 gal (0.17 acre-ft) of water per well would be needed for completion and testing operations. The estimated maximum per well water requirement for all drilling, completion, and testing operations would be approximately 1,105,000 gal (3.4 acre-ft), and the estimated maximum LOP water requirements for the 56 wells would be approximately 62 million gal (189.9 acre-ft). The average annual rate of water use would be approximately 9.5 to 19.0 acre-ft per year.

2.1.4 Production

Once a well has been tested and deemed to be commercially productive, it would be equipped for production. Figure 2.3 shows a typical single well location production facility. Reclamation of areas unnecessary for production operations--approximately 2.8 acres at each well location--would reduce LOP disturbance at each location to approximately 1.0 acre. All aboveground production facilities would be painted with standard environmental colors (e.g., Carlsbad Canyon) that blend with the surrounding landscape.

A series of valves designed to control pressures and regulate flows from the well would be installed at the well head. Flows from the wellbore would pass through the valves to a separator where the gas would be separated from the condensates and water in the gas stream. Liquids would be diverted to storage tanks. Water remaining in the natural gas stream would be removed with a skid-mounted glycol dehydration system (dehydrator) and routed to an appropriately protected collection container. Therefore, each well location would likely include a separator, dehydrator, production tanks, automation equipment, and well head. At some individual well locations, existing compressor sites, or new sites, additional compressor packages may be installed. These packages would facilitate the transportation of natural gas to a gathering and/or pipeline system and, where required by law, would be designed with best available control technology (BACT) with respect to emissions. An unknown capacity of additional compression may be required for the Proposed Action and oxide of nitrogen (NO_x) emissions from this compression would total less than 200 tons per year (tpy).

Natural gas production from wells in the VBPA are anticipated to average from 1 to 2 million cubic feet (mmcf) per day (mmcfd). Table 2.2 shows the typical content of gas produced from existing wells within the VBPA. No hydrogen sulfide (H_2S) is known from VBPA gas sources, and none is expected to be encountered during project operations.

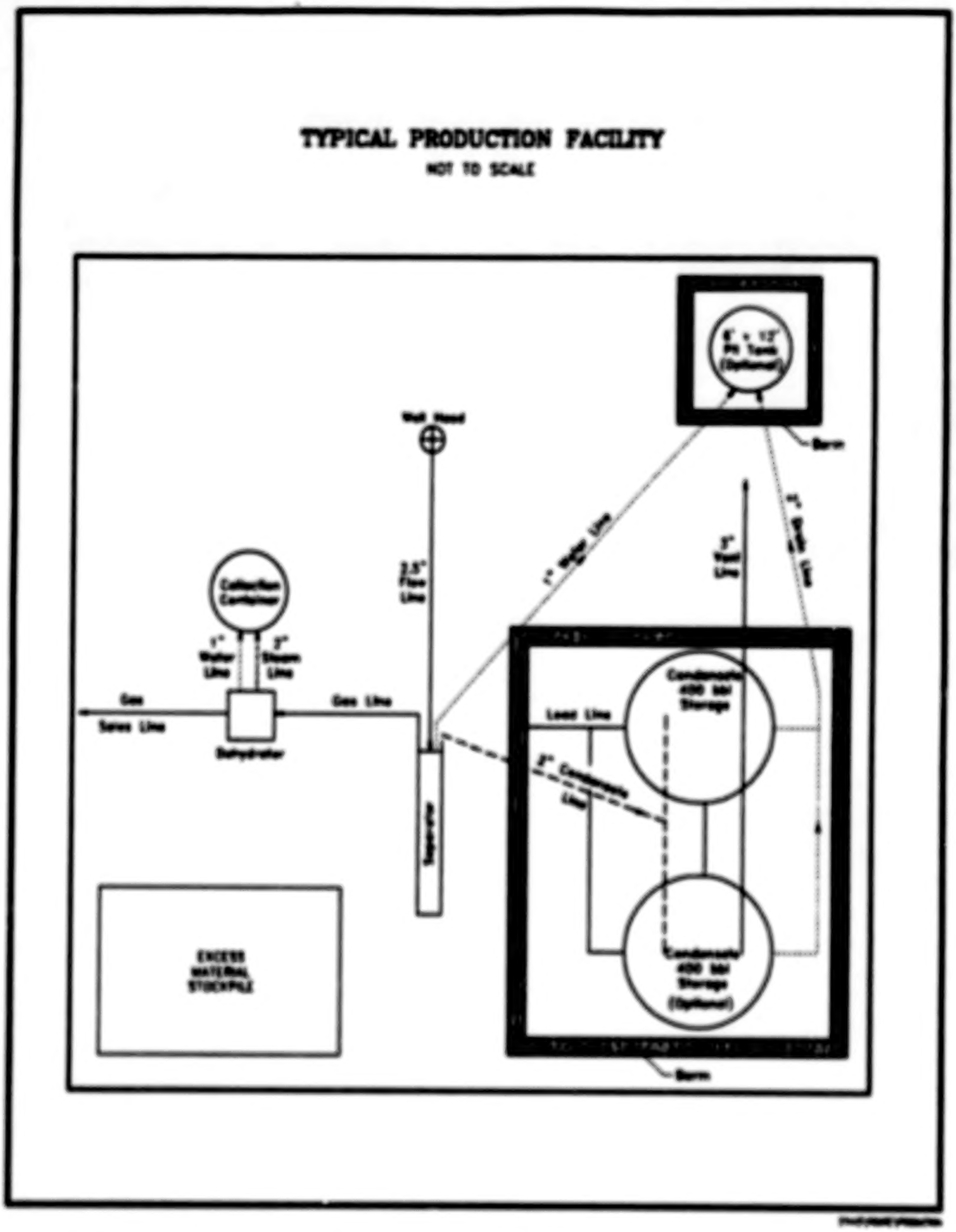


Figure 2.4 Typical Single Well Location Production Facility Schematic, Vermillion Basin Natural Gas Project, Sweetwater County, Wyoming, 2000.

Table 2.2 Gas Composition from 45 Existing Wells, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

Component	(%)[1]
Methane	82.6 - 96.7
Ethane	0.3 - 7.8
Carbon dioxide	0.9 - 4.0
Propane	0.0 - 3.9
Butane	0.0 - 1.0
Isobutane	0.1 - 0.9
Nitrogen	0.0 - 2.1
Isopentane	0.0 - 0.6
Pentane	0.0 - 0.7
Hexanes	0.0 - 2.2
Heptanes	0.0 - 0.2
Octanes	0.0 - 0.2

[1] Based on gas analysis results of 45 existing wells within the Canyon Creek-Vermillion Complex, Vermillion Creek, Pioneer, Kinney, and Trail Units (Questar Applied Technologies, unpublished data, 1999).

Wells are expected to produce from 1.0 to 16.4 bbls of condensate per day (bcpd), with an estimated average of 3.1 bcpd. Condensates consist primarily of long chain hydrocarbon liquids (e.g., pentanes, hexanes, heptanes, octanes) (Table 2.2). Condensates would be stored in tanks at well locations or piped to tank batteries at centralized processing facilities, and all tank batteries would be bermed to contain the volume of the largest tank plus sufficient freeboard (≥ 1 ft) to handle precipitation in compliance with 43 C.F.R. 3262 and 40 C.F.R. 112.7. On average, condensates would be removed from storage tanks and transported by truck for sale to refineries twice a month.

The volume of water produced at each well is expected to be similar to that of the existing wells in the VBPA and would range from 0.22 to 47.5 42-gal bbls per day with an average of approximately 4.5 bbls per day. Water removed from the gas stream would be stored in tanks or earthen pits at the well locations, and would be removed as necessary and transported by vacuum truck for disposal at permitted facilities according to WDEQ rules and regulations and BLM Onshore Oil and Gas Order No. 7.

Producing wells would be visited from one to five times each week for routine well maintenance operations. On average, each well location would be visited twice a week.

The productive life of wells in the VBPA is expected to be from 5 to 30 years.

2.1.5 Pipelines

Gas produced from VBPA wells would be transported from each well location through newly constructed underground or surface gathering system pipelines. These lines would connect to larger existing interstate gas transportation pipelines in the VBPA. At present, it is assumed that existing interstate gas pipeline capacity would be adequate for the gas transportation needs required for this project. In the event that additional interstate pipelines become necessary, additional NEPA analyses would be conducted.

The exact location of newly proposed pipelines cannot be determined at present; however, industry standard pipeline equipment, materials, techniques, and procedures in conformance with all applicable regulatory requirements would be employed during construction, testing, operation, and maintenance of pipelines to ensure safe and efficient pipeline operation. Depending upon the location of acceptable pipeline tie-ins, pipeline ROWS would be located adjacent to roads to minimize surface disturbance and maximize construction and gas transport efficiency. For the purpose of this analysis, surface disturbance calculations assume that all pipelines would parallel roads and that the maximum total pipeline and road disturbance width would be 80 ft (50 ft for pipelines [25 ft within road ROWs] and 55 ft for roads). However, in some instances pipelines may not be buried or follow roads due to environmental and/or economic considerations.

Pipeline ROW widths generally would be 50 ft (25 ft within road ROWs), and an estimated average of 0.5 mi of pipeline would be required for each well on the VBPA. New buried gas pipelines generally would be 3-6 inches in diameter and buried to depths of 2.5-6.0 ft. To provide additional protection to visual, habitat, and/or subsurface resources and to minimize surface disturbance, pipelines may be located aboveground in some areas. Approximately 3.0 acres of short-term disturbance would occur per mile of pipeline. The estimated extent of surface disturbance associated with pipeline construction for this project is presented in Table 2.1.

Sufficient topsoil to facilitate reclamation would be removed from pipeline ROWs before construction. Where ROWs do not require major excavation, vegetation may be stripped to ground level (scalping) using mechanical treatments, leaving topsoil intact and minimizing disturbance to plant root systems, thereby facilitating vegetation reestablishment.

Hydrostatic or pneumatic testing would ensure the integrity of newly constructed pipelines. Hydrostatic testing consists of filling pipeline segments with water and pressurizing the segments to levels exceeding operating pressures. Pneumatic testing involves pressurizing the pipe with air. If leaks or ruptures occur, they would be repaired and testing would be repeated until successful. Water used for hydrostatic testing would either be produced water or water acquired from Wyoming State Engineer's Office (WSEO)-permitted ground water wells. After testing, this water would be pumped into tank trucks and reused for drilling or further pipeline testing, thereby avoiding the discharge of water on the ground surface. In some instances, produced water used for testing may be hauled to existing approved disposal facilities.

2.1.6 Operations and Maintenance

2.1.6.1 Maintenance

All roads, wells, pipelines, and ancillary facilities would be operated in a safe and efficient manner according to industry standards. Routine maintenance of producing wells would be necessary to maximize performance and detect potential difficulties. Each producing well location would be visited twice a week on average to ensure operations are proceeding efficiently. All roads and well locations would be inspected periodically by Operators and the BLM and maintained by Operators to minimize erosion and assure safe operating conditions.

2.1.6.2 Workovers

Each well would require a workover approximately once every 10 years to change or replace tubing, re-fracture producing formations, clear water and other debris from the wellbore and perforations, and/or recomplete the well in existing or another potentially productive zone not completed at the time the well was first drilled. While some wells may never require workovers and others may need workovers more than once every 10 years, wells would generally require three workovers each. Workovers would be conducted primarily during daylight hours, and the BLM would be consulted prior to initiating workovers (i.e., Sundry Notice) on federal lands in crucial wildlife areas during critical periods.

2.1.7 Ancillary Facilities/Gravel Pit

At this time, no new compressor stations, gas processing plants, water wells, water disposal facilities, or power lines are anticipated for the Proposed Action. One or more new gravel pits, estimated at a total of 20 acres in size, may be required during project development (i.e., first 20 years) to provide the estimated 71,000 yds^3 of material necessary for road surfacing (see Map 2.1 for tentative locations). Existing facilities, including the Vermillion Compressor (6.5 acres), Lateral 706 Compressor (1.0 acre), Canyon Creek-Vermillion Complex (12.1 acres), Big Drop Compressor (1.0 acre), and four water wells (0.5 acre each, 2.0 acres total) would be utilized for this proposed project.

2.1.8 Workforce and Traffic

The anticipated workforce for the Proposed Action is summarized in Table 2.3, and traffic requirements in Table 2.4. Access road and well pad construction would require approximately four workers for 5 days and 20 round trips per location. Gravel hauling would also be required for some roads. Access road/well pad construction crews would usually be contracted locally by Operators.

Rig transport and on-site assembly would be completed in approximately 4 days and would involve approximately 15 workers per site and 60 round trips per site.

Drilling would require approximately 21 workers, including three 5-person rig operation crews per well to conduct drilling 24-hr/day from 20 to 120 days per well. Most project personnel would be hired locally. Approximately 560 round trips to each well location would be required during drilling operations.

Estimated workforce requirements for completion and testing operations would be 15 workers for approximately 15 days per well, with a total of 75 round trips per well.

Pipeline installation would require a crew of six workers approximately 3 days per location and 18 round trips.

Well operations and maintenance would require 12 workers and 288 worker years, with an estimated 1,560 round trips per well.

Table 2.3 Estimated Workforce Requirements, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

Employment Category	Number of Workers/Well	Number of Simultaneously Active Crews	Total Worker Days/Well	Total Worker Years[1]
Well Construction/Development				
Access road and well pad construction (5 days/location)	4	3	20	4.3
Rig transport and rig-up operations (4 days/well)	15	5	60	12.9
Drilling (20-120 days/well)	21	5	1,680[3]	361.8
Completion/testing (15 days/well)[2]	15	1	225	48.5
Pipeline installation (3 days/location)	6	3	18	3.9
Operations/Maintenance (30 years/well)				
Production (LOP)[4]	12	1	1,337	288.0
Workovers/abandonment (10 days every 10 years/well)	7	1	210	45.2
Reclamation (3 days/location)	3	1	9	1.9
Total	–	–	3,559	766.5

[1] Assumes all 56 wells are drilled and completed as producers, is based on 260 workdays per year, and assumes a well life of 30 years and a LOP of 50 years.

[2] Eight to 15 people are required during fracturing only; only one fracturing crew would be used.

[3] Assumes an average of 80 days/well.

[4] Includes one production foreman, 2 pumpers, and one field clerk (30 years); and one two-person hauler crew, one three-person rig service crew, and one four-person roustabout crew (20 years). Each well location would be visited twice per week on average, 15-20 wells/locations could be visited daily by a single employee, and approximately 50% of project personnel requirements would be covered by existing Operator personnel.

Table 2.4 Estimated Traffic Requirements[1], Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

Type of Traffic	Round Trips per Well/Location	LOP Round Trips Required for Maximum Development
Well Construction/Development		
Access road and well pad construction (5 days/location)	20	1,120
Gravel hauling	33	1,848
Rig transport and rig-up operations (4 days/well)	60	3,360
Drilling activities (20-120 days/well)[2]	560[3]	31,360
Completion/testing (15 days/well)[2]	75	4,200
Pipeline installation (3 days/location)	18	1,008
Total Well Construction/Development (47-147 days/location)	766	42,896
ADT[4]	7.2	8.2
Operations/Maintenance		
Operations (LOP)[5]	1,560	87,360
Workovers (10 days every 10 years/well)[2]	70	3,920
Total Operations/Maintenance	1,630	91,280
ADT[4]	0.2	11.7
Total Reclamation (3 days/location)	9	504
GRAND TOTAL	2,405	134,680
ADT[4]	0.3	10.4

[1] Assumes all 56 wells are drilled and completed as producers, wells produce every day, well life is 30 years, and the LOP is 50 years.

[2] Assumes some car pooling.

[3] Assumes 80 days/well.

[4] ADT = average daily traffic.

[5] Each well location would be visited twice a week on average, and approximately 15-20 well locations could be visited daily by a single employee.

Workovers would require a crew of seven for 10 days and approximately 70 round trips per location (assumes three workovers per well).

Reclamation would require a crew of three workers 3 days at each well location.

A total of approximately 766.5 worker years would be required to construct, develop, and produce the Proposed Action of 56 wells (Table 2.3). An estimated total of 134,680 round trips (to and from the VBPA) would be required, and the average daily traffic is estimated at approximately 10 vehicles per day for the LOP (Table 2.4).

No mancamps or other temporary housing is proposed within the VBPA.

2.1.9 Transportation

Access to the VBPA would be from the arterial roads, WY-430, Sweetwater County Roads 4-19 and 4-25, and other existing field access roads (see Map 2.1). To access new well locations and facility sites, new roads would be constructed and existing roads may be improved, including portions of existing arterial roads. No new access off WY-430 is proposed; however, in the event that additional access is required to the VBPA, all approaches would be paved within the WY-430 ROW, and new access roads would also be graveled for approximately 0.5 mi from the highway intersection to minimize the amount of mud tracked onto the highway. Intersection improvements, including turn lanes and wider approaches, may also be provided by Operators as directed by WDOT to handle project-related traffic. Site-specific analyses would be conducted on new and improved roads, and proper ROW authorizations would be obtained prior to construction. Road authorization, use, and maintenance responsibilities would be coordinated with area users, and roads on federal lands would be constructed following guidelines in the BLM road standards manual, Section 9113 (BLM 1985, 1991a). Roads would be built and maintained to provide year-round access.

Project-related traffic would be restricted to WY-430, Sweetwater County Roads 4-19 and 4-25, other existing improved roads within the VBPA, and newly constructed or upgraded roads developed for the project. Use of unimproved roads would be allowed only in emergency situations. Operators would instruct project personnel and contractors to adhere to speed limits commensurate with road type, traffic volume, vehicle type, and site-specific condition to assure safe and efficient traffic flow. Signs would be posted along roads as directed by the BLM for travel restrictions and other standard traffic control information. All equipment and roads would be maintained to minimize impacts to air quality and noise and to ensure human safety.

2.1.10 Geophysical Activities

Geophysical operations including 3-D surveys, velocity surveys, normal incident vertical seismic profiles, and/or offset vertical seismic profiles may be required during the LOP as drilling activity moves into areas of the VBPA with marginal or unknown gas reserves. The majority of these surveys would likely utilize 3-D seismic techniques and employ vibrator trucks or shothole methods. These surveys would be subject to separate environmental analyses for compliance with NEPA and are expected to cause minimal surface disturbance or long-term impacts to vegetation and soils. Cultural resource inventories and other surveys for sensitive environmental resources would be conducted prior to implementation as directed by the BLM. After BLM or WOGCC approval, all geophysical operations would be implemented using procedures specified in the BLM's GRRA RMP.

Geophysical exploration generally involves the use of an energy source (vibrator trucks or shotholes), geophones/receivers (listening devices), and computer processing equipment (recorder truck). Receivers are arranged in a grid pattern, with receiver line spacing usually 0.25 mi apart and geophone spacing at 220-ft intervals along the line. Energy source lines are generally 0.5 mi apart, with vibrating or shothole points at 220-ft intervals along the line. Shotholes are usually less than 250 ft deep, with diameters of 3.5-8.4 inches. Trucks ranging in size from the 26-ton vibrator trucks to 1-ton pickups would access lines using existing roads and cross-country travel. Backtracking would be kept to a minimum, and all-terrain vehicles (ATVs) and/or helicopters would be used to transport personnel and equipment in difficult terrain or areas designated as sensitive to vehicular traffic. Observation of recent 3-D geophysical operations conducted in similar areas show no long-term damage to vegetation and soils.

2.1.11 Reclamation and Abandonment

Reclamation would be conducted on all disturbed lands in compliance with BLM's *Wyoming Policy on Reclamation* (BLM 1990a). Erosion control, restoration, and revegetation plans would be prepared as components of surface use plans by Operators on a site-specific basis during the APD and ROW application process, and these plans would be approved by the BLM prior to site disturbance. The short-term reclamation goal would be to stabilize disturbed areas as rapidly as possible, whereas the long-term goal would be to return the land to conditions approximating those which existed prior to disturbance.

Reclamation would occur during two phases. After production facilities are installed, reclamation would be initiated on unnecessary portions of productive well locations (approximately 2.8 acres/location) and road ROWs to these locations (approximately 11.5 ft along each side of the road). Reclamation of all disturbed surface areas along pipeline ROWs would also be initiated as soon as practical after disturbance (e.g., the first appropriate season), and reclamation--grading, ripping, retopsoiling, and reseeding--would be completed within 2 years. This initial reclamation would reduce the amount of disturbed area to only that necessary for production operations.

When an Operator is ready to abandon a well, an abandonment plan including an abandoned wellbore schematic would be submitted to BLM and/or WOGCC, and if acceptable, the BLM and/or WOGCC would approve and authorize activities through a

Sundry Notice. The well would be plugged according to BLM Onshore Oil and Gas Order No. 2 or WOGCC rules and regulations (WOGCC 1998). Reclamation for all abandoned well locations and access roads would be initiated as soon as practical, according to BLM specifications, and reclamation activities would be completed within 2 years. This reclamation would include leveling and recontouring of disturbed areas, soil ripping, installation of water diversion and/or erosion control devices, redistribution of topsoil over disturbed areas, and reseeding. Reclamation would follow guidelines presented in the GRRA RMP and as specified in APD Surface Use Plans and/or ROW Plans of Development.

At the end of the project's useful life (estimated at 30-50 years), Operators would obtain all necessary authorizations from the appropriate regulatory agencies and/or landowners to abandon facilities. All aboveground facilities would be removed and all unsalvageable materials would be disposed of at appropriate sites. Wells would be permanently or temporarily plugged or shut-in, according to BLM and/or WOGCC recommendations. Pipelines would be purged of combustible materials and abandoned in place or removed based on authorizing agency or landowner specifications. The well pad would be reclaimed and revegetated as outlined in site-specific APD Surface Use Plans. Roads would be reclaimed according to procedures identified in ROW Plans of Development, unless they are determined to be left in place by the authorizing agency or private landowner. Any excess topsoil from roads that would not be reclaimed would be used to reclaim well pads. Regrading, ripping (12 to 18 inches), topsoiling, and revegetation would be completed on all disturbed areas. Proposed seed mixtures approved by the BLM in the GRRA RMP, or in accordance with the latest reclamation policy, would be broadcast or drill seeded. Reclaimed and abandoned locations and ROWs would revert to appropriate agency or landowner control.

2.1.12 Hazardous Materials

Operators have reviewed the U.S. Environmental Protection Agency's (EPA's) Consolidated List of Chemicals Subject to Reporting Under Title III of the *Superfund Amendments and Reauthorization Act of 1986* (SARA) (as amended) to identify any hazardous substances proposed for production, use, storage, transport, or disposal by this project, as well as the EPA's List of Extremely Hazardous Substances as defined in 40 C.F.R. 355 (as amended), and have determined that materials listed as hazardous and/or extremely hazardous would be used or generated by this project (Table 2.5). Hazardous materials anticipated to be used or produced during the implementation of the proposed project can generally be included in the following categories: drilling materials, casing and cementing materials, fracturing materials, production products, fuels, combustion emissions, and miscellaneous materials (BLM 1998a).

Operators and their contractors/subcontractors would comply with all applicable hazardous material laws and regulations and would locate, handle, and store hazardous substances in an appropriate manner to prevent them from contaminating sensitive resources. Notice of any spill or leakage, as defined in BLM NTL 3A, would be reported by the Operator to the BLM and other federal and state officials (e.g., WDEQ) as required by law. Incidents requiring verbal notification by regulation would be given as soon as possible, but no later than 24 hrs after the discovery of the incident. Verbal notification would be confirmed in writing within 15 days or other such time required by the appropriate regulatory agency. Any release of hazardous substances (leaks, spills, etc.) in excess of the reportable quantity, as established by 40 C.F.R. 117, would be reported as required by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, (CERCLA) as amended (42 U.S.C. 9601 et seq.). If the release of a hazardous substance in a reportable quantity does occur, a copy of the report would be furnished to the BLM and all other appropriate federal and state agencies.

Table 2.5 Hazardous and Extremely Hazardous Materials Potentially Utilized or Produced During Construction, Drilling, Production, and Reclamation Operations by the Vermillion Basin Natural Gas Project, Sweetwater County, Wyoming, 2000.

Source	Approximate Quantities Used or Produced Per Well^a	Hazardous Substances^b	Extremely Hazardous Substances^c	CAS No.
Drilling Materials				
Barite	14,000 lbs	Barium compounds Fine mineral fibers		– –
Bentonite	45,000 lbs	Fine mineral fibers		–
Caustic soda	750 lbs	Sodium hydroxide		1310-73-2
[illegible]	20 gal	Isopropyl alcohol		67-63-0
Lime	3,500 lbs	Calcium hydroxide		1305-62-0
Mica	600 lbs	Fine mineral fibers		–
Modified tannin	250 lbs	Ferrous sulfate Fine mineral fibers		7720-78-7 –
Phosphate esters	100 gal	Methanol		67-56-1
Polyacrylamide	100 gal		Acrylamide	79-06-1
		PAHs^d		–
		Petroleum distillates		64742-47-8
		POM^e		–
Sawdust	400 lbs	Fine mineral fibers		–
Cementing and Plugging Materials				
Anti-foamer	100 lbs	Glycol ethers		–
Calcium chloride flake	2,500 lbs	Fine mineral fibers		–
Cellophane flake	300 lbs	Fine mineral fibers		–
Cement	77,000 lbs	Aluminum oxide Fine mineral fibers		1344-28-1 –
Chemical wash	800 gal	Ammonium hydroxide Glycol ethers		1336-21-6 –
Diatomaceous earth	1,000 lbs	Fine mineral fibers		–
Extender	17,500 lbs	Aluminum oxide Fine mineral fibers		1344-28-1 –
Fluid loss additive	900 lbs		Acrylamide	79-06-1
		Fine mineral fibers Naphthalene		– 91-20-3
Friction reducer	160 lbs	Fine mineral fibers Naphthalene PAHs POM		– 91-20-3 – –
Mud flush	250 lbs	Fine mineral fibers		–
Retarder	100 lbs	Fine mineral fibers		–
Salt	3,570 lbs	Fine mineral fibers		–
Silica flour	4,800 lbs	Fine mineral fibers		–

Table 2.5 (Continued)

Source	Approximate Quantities Used or Produced Per Well[a]	Hazardous Substances[b]	Extremely Hazardous Substances[c]	CAS No.
Fracturing Materials				
Biocides	6 gal	Fine mineral fibers		–
		PAHs		–
		POM		–
Breakers	145 lbs	Ammonium persulphate		7727-54-0
		Ammonium sulphate		7783-20-2
		Copper compounds		–
		Ethylene glycol		107-21-1
		Fine mineral fibers		–
		Glycol ethers		–
Clay stabilizer	30 gal	Fine mineral fibers		–
		Glycol ethers		–
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		PAHs		–
		POM		–
Crosslinkers	40 gal	Ammonium chloride		12125-02-9
		Methanol		67-56-1
		Potassium hydroxide		1310-58-3
		Zirconium nitrate		13746-89-9
		Zirconium sulfate		14644-61-2
Foaming agent	120 gal	Glycol ethers		–
Gelling agent	950 gal	Benzene		71-43-2
		Ethylbenzene		100-41-4
		Methyl tert-butyl ether		1634-04-4
		Naphthalene		91-20-3
		PAHs		–
		POM		–
		Sodium hydroxide		1310-73-2
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
pH buffers	40 gal	Acetic acid		64-19-7
		Benzoic acid		65-85-0
		Fumaric acid		110-17-8
		Hydrochloric acid		7647-01-0
		Sodium hydroxide		1310-73-2
Sands	2,000,000 lbs	Fine mineral fibers		–
Solvents	30 gal	Glycol ethers		–
Surfactants	15 gal	Glycol ethers		–
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		PAHs		–
		POM		–

Table 2.5 (Continued)

Source	Approximate Quantities Used or Produced Per Well[a]	Hazardous Substance[b]	Extremely Hazardous Substance[c]	CAS No.
Production Products				
Natural gas	0.25->3.5 mmcfd	n-Hexane		110-54-3
		PAHs		-
		POM		-
Liquid hydrocarbons	<5-350 bpd	Benzene		71-43-2
		Ethyl benzene		100-41-4
		n-Hexane		110-54-3
		PAHs		-
		POM		-
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Produced water/drill cuttings	<20 bpd water and an unknown quantity of cuttings	Barium		7440-39-3
		Cadmium		7440-43-9
		Chromium		7440-47-3
		Lead		7439-92-1
		Manganese		7439-96-5
		Radium 226		-
		Uranium		-
		Other radionuclides		-
Fuels				
Diesel fuel	>36,500 gal	Benzene		71-43-2
		Cumene		98-82-8
		Ethylbenzene		100-41-4
		Methyl tert-butyl ether		1634-04-4
		Naphthalene		91-20-3
		PAHs		-
		POM		-
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Gasoline	Unk	Benzene		71-43-2
		Cumene		98-82-8
		Cyclohexane		110-82-7
		Ethylbenzene		100-41-4
		n-Hexane		110-54-3
		Methyl tert-butyl ether		1634-04-4
		Naphthalene		91-20-3
		PAHs		-
		POM		-
			Tetraethyl lead	78-00-2
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3

Table 2.5 (Continued)

Source	Approximate Quantities Used or Produced Per Well[a]	Hazardous Substances[b]	Extremely Hazardous Substances[c]	CAS No.
Jet A	Unk	Benzene		71-43-2
		Cumene		98-82-8
		Cyclohexane		110-82-7
		Ethylbenzene		100-41-4
		n-Hexane		110-54-3
		Methyl tert-butyl ether		1634-04-4
		Naphthalene		91-20-3
		PAHs		-
		POM		-
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Natural gas	Unk	n-Hexane		110-54-3
		PAHs		-
		POM		-
Propane	Unk	Propylene		115-07-1
Geophysical Survey Materials				
Explosives, fuses, detonators, boosters, leads	Unk	Aluminum		7429-90-5
		Ammonium nitrate		6484-52-2
		Benzene		71-43-2
		Cumene		98-82-8
		Ethylbenzene		100-41-4
		Ethylene glycol		107-21-1
		Lead compounds		7439-92-1
		Methyl tert-butyl ether		1634-04-4
		Naphthalene		91-20-3
		Nitric acid		7697-37-2
		Nitroglycerine		55-63-0
		PAHs		-
		POM		-
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Pipeline Materials				
Coating	Unk	Aluminum oxide		1344-28-1
Cupric sulfate solution	Unk	Cupric sulfate		7758-98-7
		Sulfuric acid		7664-93-9
Diethanolamine	Unk	Diethanolamine		111-42-2
LP Gas	Unk	Benzene		71-43-2
		n-Hexane		110-54-3
		Propylene		115-07-1
Molecular sieve	Unk	Aluminum oxide		1344-28-1
Pipeline primer	Unk	Naphthalene		91-20-3
		Toluene		108-88-3
Potassium hydroxide solution	Unk	Potassium hydroxide		1310-58-3

Table 2.5 (Continued)

Source	Approximate Quantity Used or Produced Per Well[a]	Hazardous Substance[b]	Extremely Hazardous Substance[c]	CAS No.
Rubber resin coatings	Unk	Acetone		67-64-1
		Coal tar pitch		68187-57-5
		Ethyl acetate		141-78-6
		Methyl ethyl ketone		78-93-3
		Toluene		108-88-3
		Xylene		1330-20-7
Emissions				
Gases	Unk[d]	Formaldehyde		50-00-0
			Nitrogen dioxide	10102-44-0
			Ozone	10028-15-6
			Sulfur dioxide	7446-09-5
			Sulfur trioxide	7446-11-9
Hydrocarbons	Unk[d]	Benzene		71-43-2
		Ethylbenzene		100-41-4
		n-Hexane		110-54-3
		PAHs		-
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Particulate matter	Unk[d]	Barium		7440-39-3
		Cadmium		7440-43-9
		Copper		7440-50-8
		Fine mineral fibers		-
		Lead		7439-92-1
		Manganese		7439-96-5
		Nickel		7440-02-0
		POM		-
		Zinc		7440-66-6
Miscellaneous Materials				
Acids	Unk	Acetic anhydride		108-24-7
		Formic acid		64-18-6
		Sodium chromate		7775-11-3
		Sulfuric acid		7664-93-9
Antifreeze, heat control, and dehydration agents	300 gal	Acrolein		107-02-8
		Cupric sulfate		7758-98-7
		Ethylene glycol		107-21-1
		Freon		76-13-1
		Phosphoric acid		7664-38-2
		Potassium hydroxide		1310-58-3
		Sodium hydroxide		1310-73-2
		Triethylene glycol		112-27-6
Batteries	Unk	Cadmium		7440-43-9
		Cadmium oxide		1306-19-0
		Lead		7439-92-1
		Nickel hydroxide		7440-02-0
		Potassium hydroxide		1310-58-3
		Sulfuric acid		7664-93-9
Biocides	Unk	Formaldehyde		50-00-0
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
Cleaners	Unk	Hydrochloric acid		7647-01-0

Table 2.5 (Continued)

Source	Approximate Quantities Used or Produced Per Well[a]	Hazardous Substance[b]	Extremely Hazardous Substance[c]	CAS No.
Corrosion inhibitors	Unk	4-4' methylene dianiline		101-77-9
		Acetic acid		64-19-7
		Ammonium bisulfite		10192-30-0
		Basic zinc carbonate		3486-35-9
		Diethylamine		109-89-7
		Dodecylbenzenesulfonic acid		27176-87-0
		Ethylene glycol		107-21-1
		Isobutyl alcohol		78-83-1
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		Naphthalene		91-20-3
		Sodium nitrite		7632-00-0
		Toluene		108-88-3
		Xylene		1330-20-7
Emulsion breakers	Unk	Acetic acid		64-19-7
		Acetone		67-64-1
		Ammonium chloride		12125-02-9
		Benzoic acid		65-85-0
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		Naphthalene		91-20-3
		Toluene		108-88-3
		Xylene		1330-20-7
		Zinc chloride		7646-85-7
Fertilizers	Unk	Unk		–
Herbicides	Unk	Unk		–
Lead-free thread compound	27 gal	Copper		7440-50-8
		Zinc		7440-66-6
Lubricants	Unk	1,2,4-trimethylbenzene		95-63-6
		Barium		7440-39-3
		Cadmium		7440-43-9
		Copper		7440-50-8
		n-Hexane		110-54-3
		Lead		7439-92-1
		Manganese		7439-96-5
		Nickel		7440-02-0
		PAHs		–
		PCBs		–
		Zinc		7440-66-6
Methanol	300 gal	Methanol		67-56-1
Motor oil	220 gal	Zinc compounds		–
Paints	Unk	Aluminum		7429-90-5
		Barium		7440-39-3
		n-Butyl alcohol		71-36-3
		Cobalt		7440-48-4
		Lead		7439-92-1
		Manganese		7439-96-5
		PAHs		–
		PCBs		–
		Sulfuric acid		7664-93-9
		Toluene		108-88-3
		Triethylamine		121-44-8
		Xylene		1330-20-7

Table 2.5 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substance[2]	Extremely Hazardous Substance[3]	CAS No.
Paraffin control	Unk	Carbon disulfide		75-15-0
		Ethylbenzene		100-41-4
		Methanol		67-56-1
		Toluene		108-88-3
		Xylene		1330-20-7
Photoreceptors	Unk	Selenium		7782-49-2
Scale inhibitors	Unk	Acetic acid		64-19-7
		Ethylene diamine tetra		60-00-4
		Ethylene glycol		107-21-1
		Formaldehyde		50-00-0
		Hydrochloric acid		7647-01-0
		Isopropyl alcohol		67-63-1
		Methanol		67-56-1
		Nitrilotriacetic acid		139-13-9
Sealants	Unk	1,1,1-trichloroethane		71-55-6
		n-Hexane		110-54-3
		PAHs		–
		POM		–
Solvents	Unk	1,1,1-trichloroethane		71-55-6
		Acetone		67-64-1
		t-Butyl alcohol		75-65-0
		Carbontetrachloride		56-23-5
		Isopropyl alcohol		67-63-0
		Methyl ethyl ketone		108-10-1
		Methanol		67-56-1
		PAHs		–
		POM		–
		Toluene		108-88-3
		Xylene		1330-20-7
Starting fluid	Unk	Ethyl ether		60-29-7
Surfactants	Unk	Ethylene diamine		107-15-3
		Isopropyl alcohol		67-56-1
		Petroleum naphtha		8030-30-6

---

[1] lbs = pounds; gal = gallons; bpd = barrels per day; mmcfd = million cubic feet per day; Unk = unknown quantities to be listed based on information availability.

[2] Hazardous substances are those constituents listed under the Consolidated List of Chemicals Subject to Reporting Under Title III of SARA, as amended.

[3] Extremely hazardous substances are those defined in 40 C.F.R. 355.

[4] PAHs = polynuclear aromatic hydrocarbons

[5] POM = polycyclic organic matter

[6] Includes nitrogen oxides (NO_x) and sulfur dioxide (SO_2) emissions.

[7] Includes volatile organic compound (VOC) emissions.

[8] Includes particulate matter less than 10 microns diameter (PM_{10}) emissions.

Each Operator would also prepare and implement, as necessary, the following plans and/or policies:

- pursuant to 40 C.F.R. 112, spill prevention, control, and countermeasure (SPCC) plans prepared for those sites where SPCC plans are applicable;
- spill response plans (oil/condensate);
- plans and inventories of hazardous chemical categories pursuant to Section 312 of SARA, as amended; and
- emergency response plans.

Copies of these plans would be maintained with the Operators, as required by regulation, and would be made available for review upon request.

2.1.13 Applicant-Committed Practices

The following applicant-committed measures would be implemented by Operators to minimize impacts to the environment. Mitigation measures may be waived when deemed inappropriate by the BLM if a thorough analysis determines that the resource(s) for which the measure was developed would not be impacted. Further site-specific mitigation measures may be identified during APD and ROW application review processes. To assure compliance with the applicant-committed mitigation measures identified in this EA and in APDs and ROW applications, Operators would provide a monitor to be available during construction operations who would consult with the BLM on a case-by-case basis as necessary during field development.

All of the proposed applicant-committed mitigation measures identified in this section would be implemented on all federal lands in the VBPA under the Proposed Action. Implementation of these measures on state and private lands would be subject to state or landowner preferences and agreements with individual Operators. All existing lease stipulations would be applied on the applicable leases within the VBPA. Development activities on all lands, including those implemented under the No Action Alternative, would be conducted in accordance with all appropriate federal, state, and county laws, rules, and regulations.

2.1.13.1 Preconstruction Planning and Design Measures

1. Operators and the BLM would conduct on-site interdisciplinary team (IDT) inspections and/or environmental reviews of each proposed area of disturbance (well sites, roads, pipelines, etc.) to develop site-specific recommendations and mitigation measures.
2. Operators would adhere to the specifications, guidelines, and development protocol identified for this project. Roads on federal lands required for the proposed project would be in accordance with BLM Manual 9113 guidelines (BLM 1985, 1991a).
3. Operators would prepare and submit individual drill site design plans to the BLM for approval prior to initiation of construction. These plans would show the layout of the well location over the existing topography, dimensions of the pad, volumes and cross sections of cut-and-fill, location and dimensions of reserve and flare pits, and access road design. Approval of individual project components (i.e., wells, roads, pipelines, and ancillary facilities) would be contingent on completion and acceptance of a site-specific cultural resource literature search; Class III inventory report; paleontological inventory (as necessary); threatened, endangered, proposed, candidate, and sensitive species surveys; sage grouse lek clearance; raptor nest clearance; and any other clearance specified by the BLM.
4. Prior to construction, operators would submit a Surface Use Plan or a Plan of Development for each well site, pipeline segment, and access road project. The plan would detail the measures and techniques to be used for erosion control, revegetation, and restoration and would adhere to reclamation guidelines present in the GRRA RMP. The plan would provide specific

detail on project administration, time frames, responsible parties, objectives, characteristics of site predisturbance conditions, topsoil removal, storage and handling, runoff and erosion control, seed bed preparation, seed mixes, seed application, fertilization, mulching, site protection, weed and livestock or other herbivore control, monitoring and maintenance procedures, and other site-specific mitigation and environmental protection measures. Final site locations would be confirmed by the BLM and Operators following on-site inspections.

5. Detailed engineering would be conducted for construction activities on steep and/or unstable slopes when required by the BLM, and would be approved by the BLM prior to initiating construction.
6. Operators in conjunction with the BLM would identify aggregate and other surfacing material sources for use in drill site and road construction. The appropriate surface management agency would approve these sources, including timing for extraction, prior to use.
7. Operators would obtain all necessary federal, state, and county permits, including necessary SWPPPs.

2.1.13.2 Air Quality

1. Operators would adhere to all applicable Wyoming Ambient Air Quality Standards (WAAQS), National Ambient Air Quality Standards (NAAQS), and permit requirements (including preconstruction, testing, and operating permits), as well as all other regulations, including those related to motorized equipment, as required by the WDEQ, Air Quality Division (WDEQ/AQD). Necessary air quality permits to construct, test, and operate facilities would be obtained from the WDEQ/AQD.
2. All internal combustion engines would be kept in good working order by implementing regular equipment maintenance.

3. Operators would advise personnel of appropriate speed limits as directed by the BLM to reduce fugitive dust concerns, as well as for human health and safety reasons.
4. Operators would limit NO$_x$ emissions from potential new compression in the VBPA to less than 200 tpy.
5. Operators would not allow open burning of garbage or refuse at well locations or other facilities in the VBPA. Any other open burning would be conducted under the permitting provisions of the *Wyoming Air Quality Standards and Regulations* (WDEQ/AQD 1989).
6. Operators would initiate immediate abatement of fugitive dust by application of water or other methods when air quality, soil loss, or safety concerns are identified by the BLM or the WDEQ/AQD. The BLM would approve control measures, locations, and application rates. If watering is the approved control measure, Operators would obtain the water from existing water wells.

2.1.13.3 Topography and Physiography

1. Operators would incorporate in their Surface Use Plans and Plans of Development the reclamation procedures and specifications contained in *Standard Practices Applied to Surface-Disturbing Activities* (BLM 1992:Appendix 7-2) and guidelines for road construction contained in BLM Manual, Section 9113 (BLM 1985, 1991a).
2. Areas with high erosion potential and/or rugged topography (steep slopes, stabilized sand dunes, drainages, floodplains, erosive and sandy soils) would be avoided where practical. When avoidance is not practicable, disturbed area sizes would be minimized and specialized erosion control measures would be applied.
3. Upon completion of construction and/or production activities, Operators would restore the topography to near pre-existing contours.

2.1.13.4 Geological/Paleontological Resources

1. Geologic risks would be minimized by implementing site-specific alignments for roads, pipelines, and drill pads to avoid and/or minimize disturbances to unstable areas.
2. BLM/WOGCC casing and cementing criteria would be followed to protect all subsurface mineral-bearing and useable water-bearing zones.
3. In areas of paleontological sensitivity, a determination would be made by the BLM as to whether a survey by a qualified paleontologist is necessary prior to the disturbance. In some cases, construction monitoring, project relocation, data recovery, or other mitigation would be required to ensure that significant paleontological resources are avoided or recovered during construction.
4. A literature search and paleontologic resource database evaluation (nonfield) is being prepared for this project (Erathem-Vanir Geological Consultants [EVG] and TRC Mariah Associates Inc. 2000), and all recommendations presented in the final report that are adopted by the BLM would be adhered to.
5. If paleontological resources are uncovered during surface-disturbing activities, Operators would suspend all operations that would further disturb such materials and immediately contact the BLM, who would arrange for a determination of significance and, if necessary, recommend a recovery or avoidance plan. Mitigation of impacts to paleontological resources would be on a case-by-case basis, and Operators would either avoid or protect paleontological resources.
6. Contractors and their workers would be instructed about the potential of encountering fossils and the steps to take if fossils are discovered during project-related activities. The illegality of removing vertebrate fossil materials from federal lands without an appropriate permit would be explained.

2.1.13.5 Soils

1. Adverse impacts to soils would be mitigated by minimizing disturbance; avoiding construction with frozen soil materials; avoiding areas with high erosion potential (e.g., unstable soil, dunal areas, steep slopes, drainages, floodplains), where practical; salvaging and selectively handling topsoil from disturbed areas; adequately protecting stockpiled topsoil and replacing it on the surface during reclamation; leaving the soil intact (scalping only) during pipeline construction, where possible; using appropriate erosion and sedimentation control techniques including, but not limited to, diversion terraces, riprap, and matting; and promptly revegetating disturbed areas using native species. Temporary erosion control measures such as temporary vegetation cover; application of mulch, netting, or soil stabilizers; and/or construction of barriers may be used in some areas to minimize wind and water erosion and sedimentation prior to vegetation establishment. Specific measures and locations would be specified in Surface Use Plans or Plans of Development prepared during the APD and/or ROW application processes.
2. Prior to commencement of construction, sufficient topsoil or other suitable material (up to 12 inches) would be stripped from proposed disturbance areas, including cut, fill, stockpile, and pit areas, and salvaged topsoil would be stockpiled for future reclamation operations.
3. Operators would keep the area of disturbance to the minimum necessary for any given activity while providing for safety.
4. Operators would minimize project-related travel during periods when soils are saturated and excessive rutting (>4 inches) could occur, and Operators would restrict off-road vehicle travel by employees and contract workers.
5. Where practical, Operators would locate pipelines immediately adjacent to roads or other pipelines to avoid creating separate areas of disturbance.

6. Operators would minimize construction activities in areas of steep slopes and sand dunes and would apply special slope-stabilizing practices and techniques (e.g., mulch, revegetation) in accordance with applicable geotechnical data if construction cannot be avoided in these areas.
7. Operators would not conduct construction activities on frozen or saturated soils unless an adequate plan is submitted and approved by the BLM that demonstrates that adverse impacts would be mitigated.
8. Operators would minimize disturbance to vegetated cuts and fills on new and existing roads.
9. Appropriate runoff and erosion control measures such as water bars, berms, and interceptor ditches would be installed as necessary. Reviews of erosion control structures, culverts, reclamation, etc., would be made by Operator and BLM personnel to assure compliance with specified plans and goals.
10. All drainage crossing structures would be designed to carry at least a 10-year/24-hr storm event, pursuant to guidelines in BLM Manual, Section 9113 (BLM 1985, 1991a).
11. Operators would place topsoil or other suitable growth material over all disturbed surfaces prior to revegetation and disturbed site revegetation would be initiated as soon as practical following disturbance.
12. Operators' would adhere to measures specified in SPCC Plans. Any accidental soil contamination by spills of petroleum products or other hazardous materials would be cleaned up and the soil disposed of or rehabilitated.

2.1.13.6 Water Resources

1. Erosion-prone (e.g., drainages) or high-salinity areas would be avoided where possible, and necessary construction in these areas would be done in the late summer, fall, and winter (prior to soil freezing), to avoid runoff periods.

Proper containment of oil and produced water in tanks, drilling fluids in reserve pits, and the location of staging areas for storage of equipment away from drainages would prevent potential contaminants from entering surface waters.

2. Prudent use of erosion control measures, including diversion terraces, riprap, matting, temporary sediment traps, and water bars would be employed as necessary. Interceptor dikes would be used to control surface runoff generated at well locations, and dike location and construction methods would be described in APD and ROW plans. If necessary to reduce suspended sediment loads and remove potential contaminants, Operators would treat diverted water in detention ponds prior to release to meet applicable state or federal standards. If water is discharged into an established drainage channel, the rate of discharge would not exceed the capacity of the channel to convey the increased flow. Waters that do not meet applicable state or federal standards would be evaporated, treated, or disposed of at an approved disposal facility.
3. Construction at drainage crossings would be limited to periods of low or no flow.
4. Operators would follow all practical alternatives and designs to limit disturbance within drainage channels, including ephemeral and intermittent draws.
5. Channel crossings by pipelines would be constructed so that the pipe is buried at least 4 ft below the channel bottom.
6. Channel crossings by roads and pipelines would be constructed perpendicular (at right angles) to flow so as to minimize disturbance. If channels would be crossed by roads, culverts would be installed at all appropriate locations as specified in BLM Manual 9112 - Bridges and Major Culverts (BLM 1990b), and Manual 9113 - Roads (BLM 1985, 1991a). All stream crossing structures

would be designed to carry the 25-year discharge event or other capacities as directed by BLM.

7. Disturbed channel beds would be reshaped to their approximate original configuration.
8. All disturbances to wetlands and/or other waters of the U.S. would be coordinated with the U.S. Army Corps of Engineers (COE), and Section 404 permits would be secured as necessary prior to disturbance.
9. A 500-ft wide buffer area of undisturbed land would be left between construction sites and wetland/riparian areas, perennial channels, or open water areas, where practical.
10. A 100-ft wide buffer area of undisturbed land would be left between construction sites and ephemeral and intermittent channels, where practical.
11. All reserve pits would be constructed in cut or stabilized fill material.
12. Subsurface material in all reserve pits would be inspected during construction by BLM as deemed necessary to assess stability and permeability to determine the need for pit reinforcement or lining. If directed by the BLM and/or the WOGCC, a synthetic liner would be installed.
13. Reserve pits that contain materials potentially hazardous to the environment (BLM 1998a) would be lined if they are located at sites where ground water occurs within 50 ft of the surface or where potential ground or surface water could be contaminated.
14. If reserve pit leakage is detected, reserve pit use at the site would be curtailed as directed by the BLM until the leakage is corrected.
15. All reserve pits would be designed with at least 1.0 ft of freeboard. Operators would construct reserve pits with 2 ft of freeboard in cut areas or in compacted and stabilized fill. Subsoil material stability and permeability in the area of construction would be evaluated and the need for pit reinforcement assessed. The subsoil material at proposed pit locations would be inspected to assess soil stability and permeability and whether

reinforcement and/or lining are required. Prior to installation of reserve pit liners and/or fluids, reserve pits would be inspected by BLM personnel as deemed necessary. Earthen reserve pits would be used only after evaluation of the pit location for distance to surface waters, depth to useable ground water, and soil type and permeability and after evaluation of the fluids which would likely be retained in the pit.

16. All water used in association with this project would be obtained from WSEO-permitted ground water wells, or other existing and authorized sources; no new water withdrawals from the Green River System are proposed.

17. The discharge of all water (hydrostatic test water, stormwater, produced water) would be done in conformance with WDEQ, Water Quality Division (WDEQ/WQD) (1993), BLM Onshore Oil and Gas Order No. 7, and WOGCC (1992) rules and regulations.

18. Concentrated water flows within access road ROWs would be managed utilizing best management practices.

19. Operators would prepare SWPPPs for all disturbances greater than 5 acres in size as required by WDEQ National Pollutant Discharge Elimination System (NPDES) permit requirements. In some instances, SWPPPs for groups of wells may be developed.

20. Operators would prepare and implement SPCC Plans, where applicable, in accordance with 40 C.F.R. 112. Any spill or accidental discharge of hazardous material would be remediated. Operators would conduct an orientation for project personnel to ensure they are aware of the potential impacts that can result from accidental spills and that they know the appropriate recourse if a spill occurs.

21. BLM and/or WOGCC casing and cementing criteria would be followed to protect all subsurface mineral-bearing and useable water-bearing zones. Unproductive wells and wells that have completed their intended purpose

would be properly plugged and abandoned using procedures identified by the WOGCC and the BLM.

22. To mitigate potential impacts caused by flooding during the LOP, construction in flood-prone areas would be limited to late summer, fall, or winter when conditions are generally dry and flows are low or nonexistent. Additional mitigation to lessen any impacts from flooding or high flows during and after construction would include the avoidance of areas with high erosion potential (i.e., steep slopes, floodplains, unstable soils); reestablishment of existing contours where possible; avoidance of areas within 500 ft of wetland edges, riparian areas, and open water, where possible; avoidance of areas within 100 ft of ephemeral and intermittent drainages, where possible; and implementation of appropriate erosion and sediment control and revegetation procedures.
23. Increased sedimentation impacts to surface waters would be avoided or minimized through construction and erosion control practices approved with each authorization and through the prompt reclamation of disturbances.

2.1.13.7 Noise and Odor

1. Noise mitigation would be applied at well locations, as determined necessary on a case-by-case basis by the BLM.
2. All engines and compressor exhaust stacks would be properly muffled with industrial grade silencers and maintained according to manufacturers' specifications.
3. Construction, drilling, completion, testing, and production facility installation activities would be seasonally restricted in crucial big game winter ranges, proximal to active raptor nests during the nesting period and in sage grouse breeding and nesting areas (see Section 2.1.13.9 for appropriate distances).

4. Road use and travel pattern specifications would be designed, in part, to keep traffic to a minimum and to reduce noise impacts.
5. Housing for compressors and silencers on exhaust stacks may be used if noise from compressor stations is shown to be a problem (e.g., sage grouse strutting activity is affected).

2.1.13.8 Vegetation

1. As mutually agreed upon between Operators and the BLM, site-specific surveys for special status plant species (SSPS) would be conducted prior to any surface disturbance in areas determined by the BLM to contain potential habitat for such species (BLM Directive USDI-BLM 6840). SSPS and their habitat would be avoided where practical. Surveys would be completed by a qualified botanist as authorized by the BLM, and may be financed by Operators, and the botanist would comply with BLM's SSPS survey policy requirements. If any SSPS or their habitats are found, BLM recommendations for avoidance or mitigation would be implemented.
2. Herbicide applications would be kept at least 500 ft from known SSPS populations or other distance deemed safe by the BLM.
3. Removal or disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements, limiting equipment/materials storage yard and staging area sizes, scalping, etc.). Well locations and associated roads and pipelines would be located to avoid or minimize impacts in areas of high value (e.g., SSPS habitats, wetland/riparian areas).
4. Operators would seed and stabilize disturbed areas in accordance with the reclamation guidelines presented in the GRRA RMP (BLM 1992: Appendix 7.2). Revegetation using a BLM-approved, locally adapted seed mixture containing native grasses, forbs, and shrubs would begin in the first

appropriate season following disturbance, and vegetation removed would be replaced with plants of equal forage value and growth form using procedures that include:

- fall reseeding (September 15 to freeze-up), where feasible;
- spring reseeding (post-thaw and prior to May 15) if fall seeding is not feasible;
- deep ripping of compacted soils prior to reseeding;
- surface pitting/roughening prior to reseeding;
- utilization of native cool-season grasses, forbs, and shrubs in the seed mix;
- appropriate, approved weed-control techniques;
- broadcast or drill seeding, depending on site conditions; and
- fencing of certain sensitive reclamation sites (e.g., riparian areas, steep slopes, and areas within 0.5 mi of livestock watering facilities) as determined necessary through monitoring.

5. Recontouring and seedbed preparation would occur immediately prior to reseeding on the unused portion of well locations and road ROWs and entire pipeline ROWs outside of road ROWs. In the event of uneconomical wells, Operators would initiate reclamation of the entire well location, access road, and adjacent disturbed habitat as soon as possible. Reclamation would be monitored by the Operators and the BLM to determine and ensure successful establishment of vegetation.

6. Operators would monitor for noxious weeds and would apply BLM-approved weed control techniques, as necessary. Weed-free certification by county extension agents would be required for grain or straw used for mulching revegetated areas. Gravel and other surfacing materials used for the project would be free of noxious weeds.

7. Per COE requirements, Operators would identify all waters of the U.S., special aquatic sites, and wetlands that could be impacted by the proposed project. All project activities would be located outside of these sensitive areas, where practical.

8. Where wetlands, riparian areas, streams, or ephemeral/intermittent stream channels must be disturbed, COE Section 404 permits would be obtained as necessary, and the following measures would be employed.
    a. Wetland areas would be crossed perpendicular to flow during dry conditions (i.e., late summer, fall, or dry winters); winter construction activities would occur only when topsoil can be segregated and stockpiled separately from the subsoil.
    b. Streams, wetlands, and riparian areas disturbed during project construction would be restored to pre-project conditions, and if impermeable soils contributed to wetland formation, soils would be compacted to reestablish impermeability.
    c. Wetland topsoil would be selectively handled.
    d. Recontouring and BLM-approved species would be incorporated into reclamation procedures.
    e. Reclamation activities would begin on disturbed wetland areas immediately after completion of project activities.

9. Well field traffic would be confined, unless specifically authorized otherwise, to the running surface of roads and well pads as approved in APDs and ROWs.

2.1.13.9 Wildlife and Fisheries

1. Well locations, access roads, pipelines, and ancillary facilities would be selected and designed to minimize disturbances to areas of high wildlife habitat value, including wetlands and riparian areas.

2. Removal or disturbance of vegetation would be minimized through construction site management (e.g., by utilizing previously disturbed areas, using existing ROWs, designating limited equipment/materials storage yards and staging areas, scalping).
3. To minimize wildlife mortality due to vehicle collisions, Operators would advise project personnel regarding appropriate speed limits in the project area, and roads would be reclaimed as soon as possible after they are no longer required. Some existing roads in the area may be closed and reclaimed by Operators as authorized by the BLM. Employees and contractors would be informed about wildlife laws and, if violations are discovered, the offending employee or contractor may be disciplined and/or dismissed by Operators and/or prosecuted by the Wyoming Game and Fish Department (WGFD).
4. To protect wildlife habitat, project-related travel would be restricted to established project roads; no off-road travel would be allowed, except in emergencies.
5. Potential impacts to fisheries would be minimized by using proper erosion control techniques (e.g., water bars, jute netting, rip-rap, mulch). Construction within 500 ft of open water and 100 ft of intermittent or ephemeral channels would be avoided, where practical. Channel crossings for roads and pipelines would be constructed when flows are not expected (i.e., late summer or fall). All necessary crossings would be constructed perpendicular to flow. No surface or shallow ground water in connection with surface water would be utilized for the proposed project.
6. Operators would not perform construction activities in big game crucial winter ranges from November 15 to April 30 unless specifically allowed by the BLM.

7. Wildlife-proof fencing would be constructed around areas potentially hazardous to wildlife (e.g., reserve pits, toxic material storage locations) as deemed necessary by the BLM.
8. Wildlife-proof fencing would be utilized on reclaimed areas if it is determined that wildlife species are impeding successful vegetation re-establishment.
9. ROW fencing associated with this project would be kept to a minimum and fences, where necessary, would meet BLM and WGFD standards for facilitating wildlife passage.
10. Reserve, workover, and evaporation/production pits potentially hazardous to wildlife would be adequately protected by fencing and/or netting to exclude wildlife and ensure protection of migratory birds and other wildlife, as directed by the BLM.
11. Operators would implement policies designed to control littering by notifying all employees and contractors that any littering within the VBPA could result in dismissal.
12. Operators would internally enforce existing drug, alcohol, and firearms policies, and firearms and dogs would not be allowed on-site during working hours.
13. Any power line construction would follow recommendations by the Avian Power Line Interaction Committee (1994, 1996) and Olendorff et al. (1981) to avoid collisions and electrocution of raptors and other avifauna.
14. USFWS and WGFD consultation and coordination would be conducted as necessary for all mitigation activities related to raptors and TEP&C species (and their habitats), and all permits required for movement, removal, and/or establishment of raptor nests would be obtained.
15. In addition, the following raptor nest avoidance measures would be applied as directed by BLM.

- Well locations, pipelines, and associated roads would be selected and designed to avoid disturbances to known raptor nest sites.
- Raptor nest surveys would be conducted within a 1.0-mi radius of proposed surface use or activity areas if such activities are proposed to be conducted between February 1 and July 31.
- All surface-disturbing activity (e.g., road, pipeline, well pad construction, drilling, completion, workover operations) would be seasonally restricted from February 1 through July 31 within a 0.5-mi radius of all active raptor nests, except ferruginous hawk nests, for which the seasonal buffer would be 1.0 mi. (An active raptor nest is defined as a nest that has been occupied within the past 3 years.) The seasonal buffer distance and applicable exclusion dates may vary, depending on such factors as the activity status of the nest, species involved, prey availability, natural topographic barriers, line-of-site distance(s), and other conflicting issues such as cultural values, steep slopes, etc. Routine maintenance or emergency health and safety activities would be allowed on existing well locations.
- Well locations, roads, ancillary facilities, and other surface structures requiring repeated human presence would not be constructed within 825 ft (2,000 ft for bald eagles) of active raptor nests, where practical. Facility construction in these areas would require specific approval from the BLM.
- Operators would notify the BLM immediately if raptors are found nesting on project facilities and would assist the BLM as necessary to erect artificial nesting structures. Additional site-specific mitigations for nesting raptors would be designed, as necessary, in consultation with the BLM, USFWS, and WGFD.

16. Operators would not conduct surface-disturbing activities requiring repeated human presence within 0.25 mi of active sage grouse leks. Permanent

high-profile structures such as buildings and storage tanks would not be constructed within 0.25 mi of an active lek.

17. If, during on-site reviews conducted during the sage grouse nesting season (April 1-July 31) by a qualified biologist prior to the start of activities in potential sage grouse nesting habitat up to 2.0 mi from active leks, an active sage grouse nest is identified, surface-disturbing activities would be delayed until nesting is completed.

18. As mutually agreed upon between Operators and the BLM, site-specific surveys for TEP&C species and BLM special status animal species (SSAS) would be conducted prior to surface disturbance in areas determined by the BLM to contain potential habitat for such species. These surveys would be completed by a qualified biologist as authorized by the BLM and may be financed by Operators. If any TEP&C or SSAS or their habitats are found, BLM recommendations for avoidance or mitigation would be implemented. Minor relocation of project facilities would be made to avoid these species and/or their habitats.

19. Mountain plover surveys would not be conducted for construction activities planned for the period of July 11 through April 9.

20. During the period of May 1 - June 15, mountain plover surveys would be conducted by an Operator-financed, BLM-approved biologist in accordance with USFWS guidelines (USFWS 1999a) on suitable breeding areas (i.e., active prairie dog towns and areas with vegetation less than 4 inches in height) on or within 200 m (656 ft) of areas proposed for development during the breeding period (April 10-July 10). Survey procedures would be as follows:

    - surveys would be conducted during early courtship and territory establishment;
    - surveys would be conducted from sunrise to 10:00 a.m. and/or from 5:30 p.m. to sunset;

- surveys would be conducted from four-wheel-drive vehicles or, where access is a problem and/or no visual observations are made from vehicles, ATVs would be used;
- surveyors would remain in or close to vehicles when scanning with binoculars;
- sites would be surveyed three times during the survey window (May 1-June 15), with each survey separated by at least 14 days;
- surveys would not be conducted in inclement weather (e.g., poor visibility);
- surveys would focus on locating displaying or calling males;
- if breeding birds are observed, additional surveys would be implemented immediately prior to construction to search for active nest sites;
- if an active nest is located, a 656-ft buffer zone would be established around the nest to prevent direct and indirect nest disturbance; and
- surface-disturbing activities would occur as near to completion of surveys as possible.

21. If an active nest is found in the survey area, planned activities would be delayed 37 days, or 1 week post-hatching, or if a brood of flightless chicks is observed, activities would be delayed at least 7 days.

22. Where access roads and/or well locations have been constructed prior to the mountain plover nesting season (April 10- July 10) and use of these areas has not been initiated for development actions prior to April 10, a BLM-approved biologist would conduct site investigations of these disturbed areas prior to use to determine whether mountain plover are present. In the event plover nesting is occurring, Operators would delay development activities until nesting is complete.

23. Where development activities are occurring within 0.25 mi of nesting areas, nest success and productivity of known mountain plover nests found within

these areas would be monitored and reported to the BLM and USFWS Wyoming Field Office annually.

24. Prior to implementing surface disturbance within 200 m (656 ft) of known mountain plover concentration areas (i.e., areas where broods and/or adults have been observed in the current year or documented in at least 2 of the last 3 years), Operators would consult with the BLM regarding initiation of informal conferencing with the USFWS.

25. If removal of mountain plover nesting habitat is unavoidable, loss would be minimized by creating additional nesting habitat; it is assumed that many of the existing and proposed pipeline reclamation areas on the VBPA would provide suitable plover breeding habitats.

26. If nesting habitat is disturbed, these disturbed areas would be reclaimed to approximate original conditions (i.e., topography, vegetation, hydrology, etc.) after completion of activities in the area.

27. Where possible, proposed disturbance sites would be located to avoid prairie dog colonies which meet black-footed ferret habitat size and burrow density criteria (USFWS 1989).

28. The proposed project would not utilize any surface water or shallow ground waters that are connected to live surface waters.

29. Pursuant to the *Endangered Species Act*, Operators would adhere to all survey, mitigation, and monitoring requirements identified in the Biological Assessment (BA) for this project.

2.1.13.10 Cultural and Historic Resources

1. Operators would inform their employees and contractors about the relevant federal regulations protecting cultural resources. If any cultural remains, monument sites, objects, or antiquities subject to the *National Historic Preservation Act of 1966* (as amended) (NHPA) or the *Archaeological Resource*

Protection Act of 1979 (ARPA) are discovered during exploration and/or construction within the VBPA, activities shall immediately cease and the BLM would be notified.

2. Operators would adhere to the Section 106 compliance process (36 C.F.R. 800) or National Cultural Programmatic Agreement (NCPA) and Wyoming State Protocol (WSP) prior to any surface-disturbing activity.
3. Operators would halt construction activities in potentially affected areas if previously undetected cultural resource properties are discovered during construction. The BLM would be immediately notified, consultation with the Wyoming State Historic Preservation Office (SHPO) and the Advisory Council would be initiated as necessary, and proper mitigation measures would be developed pursuant to the WSP under the NCPA, or 36 C.F.R. 800.11. Construction would not resume until a Notice to Proceed is issued by the BLM.
4. If areas of religious importance, traditional cultural properties, or other sensitive Native American areas are identified in affected areas, BLM and affected tribes would identify potential impacts and BLM would determine appropriate mitigative treatments on a case-by-case basis. Operators may participate in the consultation process; however, responsibilities rest with BLM and tribes to consult on a government-to-government basis.
5. Provisions similar to those of the *Oregon/Mormon Pioneer National Historic Trails Management Plan* (BLM 1986a) and updated *Management Plan and Use Plan Update/Final Environmental Impact Statement: Oregon/Mormon National Historic Trails* (National Park Service [NPS] 1999) would be followed for any actions potentially affecting the Cherokee Trail or contributing portions of the Rock Springs to Browns Park Road and Rock Springs to Hiawatha Road.
6. Operators would comply with all BLM and SHPO recommendations prior to potential construction activities near known historic cabins, grave sites, or for crossings of the Cherokee Trail, Rock Springs to Browns Park Road, and

Rock Springs to Hiawatha Road. The trail would be crossed in areas of existing disturbance and no new disturbance would occur in undisturbed portions of these properties. Undisturbed portions of contributing historic trails and roads would not be used by Operators or their contractors to access exploratory or construction areas within the VBPA.

7. Operators would pay the costs of BLM-required mitigation for cultural resources caused by Operators during project construction.

2.1.13.11 Socioeconomics

1. Operators would implement hiring policies that encourage the use of local or regional workers.
2. Operators would schedule concentrations of project traffic, such as truck convoys or heavy traffic flows, to avoid periods of expected heavy traffic flows associated with recreation. Travel and parking would be restricted to access roads and on-site parking areas.
3. Where practical, Operators would plan proposed development operations so that seasonal restrictions do not create a significant reduction in the level of development, thus causing seasonal workforce layoffs (i.e., work continues at a level rate year round).

2.1.13.12 Livestock/Grazing Management

1. Operators would coordinate project activities with ranching operations to minimize conflicts with livestock movement or other ranch operations.
2. Operators would repair all fences, cattle guards, and other livestock-related structures damaged during project construction.
3. In areas of high livestock use, reclaimed areas would be fenced as necessary to ensure successful vegetation establishment.

4. Reclamation of nonessential areas disturbed during construction activities would be accomplished in the first appropriate season after well completion. Nonessential areas include portions of the well locations not needed for production operations, the borrow ditch and outslope portions of new road ROWs, entire pipeline ROWs outside of road ROWs, and all roads and associated disturbed areas at nonproductive well locations. Operators would repair or replace fences, cattleguards, gates, drift fences, and natural barriers that are damaged by development actions to maintain current BLM standards. Cattleguards would be used instead of gates for livestock control on most road ROWs. Livestock would be protected from pipeline trenches, and livestock access to existing water sources would be maintained.
5. The BLM, Operators, and livestock permittees would monitor livestock movements, especially regarding any impacts to livestock from roads or disturbance from construction and drilling activities. Appropriate measures would be taken to correct any adverse impacts, should they occur.
6. All pits containing fluids would be fenced to keep livestock from drinking any contaminated water.

2.1.13.13 Land Status/Use

1. Mitigation to prior rights would include:
   - limiting drilling operations to lands leased or owned by the Operators;
   - locating wells away from known underground cables;
   - regrading and repairing roads, as necessary, in areas damaged by project activities;
   - reestablishing a level compacted surface where pipelines cross existing roads;
   - identifying and flagging in advance of all existing ROWs that would be crossed by proposed pipelines and roads;

- backhoe and hand excavating at pipeline crossings until the exact locations of existing underground lines have been determined; and
- restoring native vegetation as soon as practical.

2. Roads and pipelines would be located adjacent to existing linear facilities wherever possible.

2.1.13.14 Recreation

1. Operators would post appropriate warning signs and require project vehicles to adhere to appropriate speed limits on project-required roads.
2. Operators would inform their employees, contractors, and subcontractors that long-term camping (more than 14 days) on federal lands or at federal recreation sites is prohibited.
3. Operators would direct their employees, contractors, and subcontractors to abide by all state and federal laws and regulations regarding hunting and artifact collecting.

2.1.13.15 Transportation

1. Detailed practices and procedures would be developed to identify the minimum road network required to support annually proposed project activities, as well as construction and maintenance responsibilities of the Operators. Dust abatement, road construction, and surfacing requirements would also be identified annually.
2. Existing roads would be used to the maximum extent possible and upgraded as necessary.
3. All Operator-constructed roads not required for routine operation and maintenance of producing wells or ancillary facilities would be reclaimed as directed by the BLM, State Land Board, or private landowner. As necessary,

these roads would be permanently blocked, recontoured, reclaimed, and revegetated by Operators, as would disturbed areas associated with permanently plugged and abandoned wells. Reclamation of existing two-track roads would be considered on a case-by-case basis.

4. Where required by the BLM, site-specific centerline surveys and/or detailed construction designs would be submitted to and approved by the BLM prior to road construction.
5. Operators would comply with existing federal, state, and county requirements and restrictions to protect road networks and the traveling public.
6. Special arrangements would be made with the WDOT to transport oversize loads to the VBPA. Otherwise, load limits would be observed at all times to prevent damage to existing road surfaces.
7. All development activities along approved ROWs would be restricted to areas authorized in the approved ROW.
8. Operators would be responsible for maintenance of roads in the project area and for closure of roads following production activities.
9. Where proposed roads would follow existing roads, those portions of existing roads not included in the new ROW would be reclaimed and revegetated by the Operator.
10. Up to 12 inches of available topsoil would be stripped from all road corridors prior to construction and would be redistributed and reseeded on backslope areas of the borrow ditch after completion of road construction. Borrow ditches would be reseeded in the first appropriate season after initial disturbance.
11. Any new access roads from WY-430 would be paved within the WY-430 ROW and graveled for 0.5 mi from the WY-430 ROW boundary to minimize the amount of mud carried onto the paved highway.

2.1.13.16 Visual Resources

1. Operators would utilize existing topography to screen roads, pipeline corridors, drill rigs, wells, and production facilities from view where possible.
2. Operators would paint all aboveground production facilities with appropriate colors (e.g., Carlsbad Canyon or Desert Brown) to blend with the adjacent terrain, except for structures that require safety coloration in accordance with Occupational Safety and Health Administration (OSHA) requirements.

2.1.13.17 Health and Safety/Hazardous Materials

1. Operators would utilize WDEQ-approved portable sanitation facilities at drill sites.
2. Operators would utilize appropriate signage as required by law.
3. Operators would place appropriate dumpsters at each construction site to collect and store garbage and refuse.
4. Operators would ensure that all refuse and garbage is transported to a State of Wyoming-approved sanitary landfill for disposal.
5. Each operator would institute a Hazard Communication Program for its employees and would require subcontractor programs in accordance with OSHA (29 C.F.R. 1910.1200).
6. Operators and/or their contractors would keep on file, at their respective offices, Material Safety Data Sheets (MSDSs) for every chemical or hazardous material that is brought on-site in accordance with 29 C.F.R. 1910.1200.
7. SPCC Plans would be written and implemented where applicable in accordance with 40 C.F.R. 112.
8. Chemical and hazardous materials would be inventoried and reported in accordance with the regulations implementing SARA Title III (40 C.F.R.

335). If quantities exceeding 10,000 pounds or the threshold planning quantity (TPQ) are to be produced or stored, the appropriate Section 311 and 312 forms would be submitted at the required times to the State and County Emergency Management Coordinators and the local fire departments.

9. Any hazardous wastes, as defined by the *Resource Conservation and Recovery Act of 1976* (RCRA), as amended, would be transported and/or disposed of in accordance with all applicable federal, state, and local regulations.

2.2 THE NO ACTION ALTERNATIVE

A No Action Alternative is considered in this NEPA document, and provides a benchmark, enabling decision makers to compare the magnitude of environmental effects of the alternatives. Under the No Action Alternative, the BLM would deny the current proposal for natural gas development on federal lands in the VBPA as currently proposed by the Operators in the Proposed Action, while allowing existing land uses to continue. Denial of the current development proposal is not, however, a denial of all natural gas development in the area. The decision of the BLM to deny an APD is not available without a No Surface Occupancy (NSO) stipulation in the lease; however, the BLM can impose "reasonable" mitigation measures on the lease if unnecessary or undue environmental degradation would occur. An oil and gas lease grants the lessee the *"right to drill for... extract, remove, and dispose of all oil and gas deposits"* from the leased lands, subject to the terms and conditions of the respective leases (BLM Form 3100-11). The denial of the right to develop a valid lease would violate the lessees' contractual rights, as well as result in the loss of federal royalties. Because the Secretary of the Interior has the authority and responsibility to protect the environment within federal oil and gas leases, restrictions are imposed on the lease terms. Although a given APD can be denied, the right to drill and develop somewhere on the leasehold cannot be denied by the BLM. To deny all activity would constitute a breach of contract of an Operator's rights to conduct development activities on the leased lands. Authority for complete denial can be granted only by

Congress (which can order the leases forfeited subject to compensation). The BLM, therefore, can only suspend the lease pursuant to Section 39 of the *Mineral Leasing Act* pending consultation with the Congress for a grant of authority to preclude drilling and provide compensation to the lessee.

For the purposes of this EA analysis, the No Action Alternative would mean that the Proposed Action would not be implemented and that other existing land uses would continue in the VBPA. This land use would include the continued operation of the 82 producing wells located in the VBPA, the associated 137.2 mi of roads, the existing pipelines, and the 23 acres of ancillary facilities. There is no other development proposed at this time, nor are any anticipated in the reasonably foreseeable future, although it is acknowledged that, given the natural gas reserves apparently available within the VBPA, projects to recover those resources are likely to be proposed in the future. If and when such projects are proposed, they would be subjected to analysis under NEPA.

With the inclusion of all existing surface disturbances on the VBPA, total long-term surface disturbance under the No Action Alternative would be 1,105 acres.

Under the No Action Alternative, site-specific NEPA analyses would be conducted for all development activities on public lands or mineral estate; however, the planning and applicant-committed measures identified for the Proposed Action would not be implemented.

2.3 ALTERNATIVES CONSIDERED BUT REJECTED

Alternatives involving project-wide well location densities, the drilling and development of varying numbers of wells, and the exclusion of development on all public lands in the VBPA were considered but rejected for economic, environmental, and/or legal reasons.

Directional drilling was also considered. Directional drilling allows multiple wells to be drilled from one well pad. These multiple wells can be serviced by one access road and gathering system pipeline, as well as a single separation, dehydration, and storage facility. However, directional drilling in the VBPA would have a lower chance of economic success when compared to vertical drilling, and the use of multi-well directional drilling techniques would be contingent upon economic, technical feasibility, and environmental considerations. Much of the VBPA is not well-suited for directional drilling; therefore, directional drilling is not being considered at this time.

2.4 SUMMARY OF ENVIRONMENTAL IMPACTS

A summary of impacts and mitigations for the Proposed and No Action analyzed in this EA is provided in Table 2.6. A detailed analysis of project impacts and mitigation measures is presented in Chapter 4.0.

Table 2.6 Summary of Environmental Consequences and Mitigation Measures, Vermillion Basin Project Area, Sweetwater, County, Wyoming, 2000.

Resource	Proposed Action	No Action	Mitigation
Climate	No impacts	No impacts	None
Air Quality	Temporary short-term construction-related increases in dust and exhaust emissions; compression emissions	No additional impacts	Dust suppression during construction; proper maintenance of construction equipment; prompt reclamation; <200 tpy of new NO_x emissions
Topography and Physiography	Some minor LOP changes in topography due to cuts and fills	No additional impacts	Avoidance of steep slopes; proper reclamation
Geology and Geologic Hazards	No impacts	No impacts	Minimize disturbance or avoid sensitive areas; prompt reclamation
Paleontology	Possible inadvertent destruction of important fossils during construction	No impacts	Preconstruction field surveys and possible monitoring in sensitive areas; recover significant discoveries
Mineral Resources	Depletion of natural gas resources	No additional impacts	Efficient recovery of natural gas resources
Soils	Disturbance of 505 acres of previously undisturbed soils	No additional impacts	Minimize disturbance; implement soil erosion practices until sites are permanently reclaimed; prompt stabilization and reclamation
Water Resources	No impacts to springs, seeps, or ground water; some increased runoff and sediment would likely reach local waterways	No impacts	Avoid channel crossings; construction in channels during periods of no or low flow; prompt stabilization and reclamation; appropriate road and well location design and maintenance
Noise and Odor	Temporary construction-related increases in noise; increased odors near wells and roads	No additional impacts	Properly muffle all construction equipment; avoid noise sensitive areas at critical times
Vegetation and Wetlands	Disturbance of 505 acres of previously undisturbed vegetation	No additional impacts	Minimize disturbance; noxious weed controls implemented; no disturbance to wetlands; prompt revegetation with native, adapted species
Wildlife and Fisheries	Direct effects from collision-related mortality; indirect effects from 505 acres of temporary and 165 acres of LOP habitat loss; temporary displacement during construction	No additional impacts	Comply with all seasonal stipulations and applicant-committed measures for wildlife protection unless otherwise authorized by the BLM; minimize disturbance; prompt reclamation

Table 2.6 (Continued)

Resource	Proposed Action	No Action	Mitigation
Wild Horses	Temporary loss of 505 acres and LOP loss of additional 165 acres of habitat	No additional impacts	Prompt reclamation
Threatened, Endangered, Proposed and Candidate, (TEP&C) Species, and Sensitive Animal and Plant Species	No adverse effects to TEP&C species; possible direct effects (e.g., collision- and/or construction-related mortality) on certain state-sensitive species or inadvertent destruction of sensitive plants	No additional impacts	Complete surveys prior to construction; avoid species habitats where practical
Cultural Resources	Some unidentified sites and artifacts could be disturbed or destroyed	No additional impacts	Complete surveys of all areas to be disturbed; avoid NRHP-eligible sites where practical; mitigate possible impacts on a case-by-case basis through the NHPA Section 106 consultation process
Socioeconomics/ Environmental Justice	Temporary beneficial economic impacts to local and state economies during construction; long-term benefits due to increased product availability; no impacts to environmental justice	Loss of positive economic benefits	Hire workers locally as available
Landownership and Use	No change in landownership; temporary loss of grazing, wildlife habitat, and recreation	No additional impacts	Prompt stabilizing after construction and reclamation of disturbed areas
Aesthetic and Visual Resources	Temporary visual impacts during construction; no long-term impacts requiring re-categorization of existing Visual Resource Management classification	No impacts	Minimize disturbance; prompt stabilization and reclamation of disturbed areas; painting aboveground features to blend with the surrounding landscape
Hazardous Materials	Possible spills	No additional impacts	Implementation of appropriate spill prevention and control measures

3.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the VBPA. The resources that are addressed here were identified during the scoping process and/or interdisciplinary team review as having the potential to be affected by project-related activities.

Critical elements of the human environment (BLM 1988), their status in the VBPA, and their potential to be affected by the proposed project are listed in Table 3.1. Four critical elements (areas of critical environmental concern, prime and unique farmlands, wild and scenic rivers, and wilderness) are not present in the VBPA and would not be affected; therefore, they are not addressed further in this EA. In addition to the remaining 10 critical elements of the human environment (Table 3.1), this EA discusses climate; topography and physiography; mineral resources; geology and geologic hazards; paleontological resources; soils; noise and odor; vegetation; wildlife and fisheries; wild horses; socioeconomics; landownership and use; aesthetics and visual resources; and hazardous materials.

3.1 PHYSICAL RESOURCES

3.1.1 Climate

The VBPA is located in a semiarid, midcontinental (dry and cold) climate typified by dry windy conditions, limited rainfall, and long cold winters. Average daily temperatures range from 10°F to 30°F in midwinter and from 50°F to 85°F in midsummer. Extreme temperatures range from -40°F (1979) to 97°F (1954) (BLM 1999a). The frost-free period generally occurs from mid-May to early October. Mean annual precipitation ranges from 6 to 9 inches and is evenly distributed throughout the year, with a minor peak in May. Mean annual snowfall in Rock Springs is 43.7 inches with extremes of nearly 80 inches. Strong and gusty winds are often accompanied by snow during the winter months, producing

Table 3.1 Critical Elements of the Human Environment[1], Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

Element	Status on the VBPA	Addressed in Text of EA
Air Quality	Potentially affected	Yes
Areas of critical environmental concern	None present	No
Cultural resources	Potentially affected	Yes
Environmental justice	Potentially affected	Yes
Farmlands, prime or unique	None present	No
Floodplains	Potentially affected	Yes
Native American religious concerns	Potentially affected	Yes
Noxious weeds	Potentially affected	Yes
Threatened and endangered species	Potentially affected	Yes
Wastes, hazardous or solid	Potentially affected	Yes
Water quality (surface and ground water)	Potentially affected	Yes
Wetlands/riparian zones	Potentially affected	Yes
Wild and scenic rivers	None present	No
Wilderness	None present	No

---

[1] As listed in BLM *National Environmental Policy Act Handbook H-1790-1* (BLM 1988) and subsequent Executive Orders.

blizzard conditions and drifting snow. Data from the Rock Springs Airport indicates a mean annual wind speed of approximately 11 mph, with winds originating from the west to southwest approximately 60% of the time (BLM 1999a). The frequency and strength of the winds facilitate the dispersion and transport of air pollutants.

The proposed project would not impact climate; therefore, climate is not discussed further in this EA.

3.1.2 Air Quality

No air quality monitoring stations are present in the Vermillion Basin; however, air quality in the area is generally excellent with measured background concentrations of all criteria pollutants well below established standards (BLM 1996). Air quality parameters in the Vermillion Basin region are shown in Figure 3.1. Visibility in the region (Green River Basin) is also generally considered excellent (Figure 3.2).

There are seven existing compressor stations operating within the Basin at the present time. All are currently permitted by the WDEQ/AQD. These compressor stations emit a total of 319.99 tpy NO_x, 331.87 tpy carbon monoxide (CO), and 219.49 tpy volatile organic compounds (VOCs). In addition, they are permitted to emit a total of 15.16 tpy of hazardous air pollutants (HAPs) including, among other things, benzene, toluene, E-benzene, and xylene (personal communication, January and April 2000, with Jeffrey L. Ingerson, Questar Market Resources Group, Salt Lake City, Utah).

3.1.3 Topography and Physiography

The VBPA is comprised of broken country including badlands, buttes, rims, flats, and basins. Major geological features include Kinney Rim, Scrivner Butte, and Rifes Rim. The landscape is primarily open undisturbed rangelands vegetated by sagebrush, grasses,

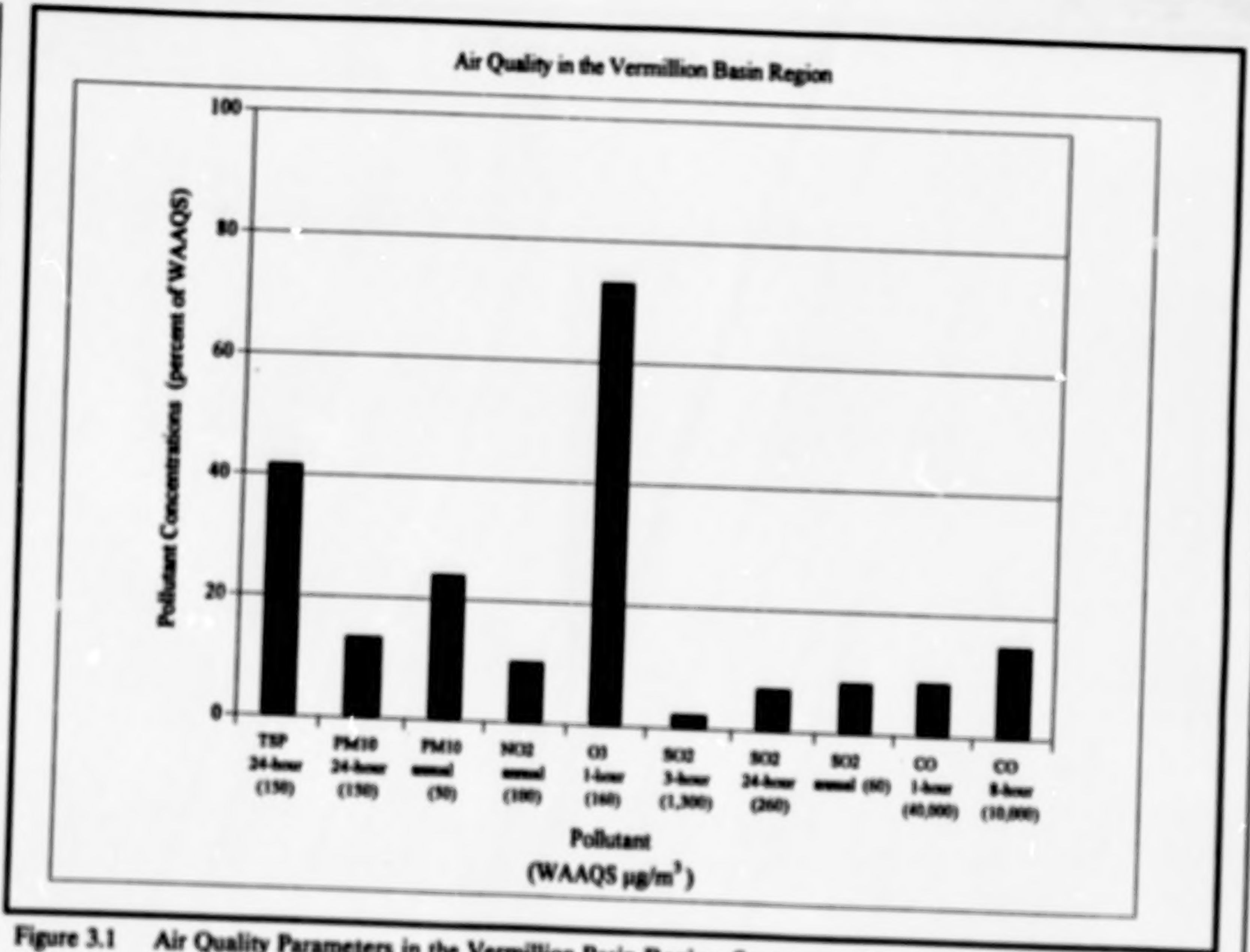


Figure 3.1 Air Quality Parameters in the Vermillion Basin Region, Sweetwater County, Wyoming, 2000.

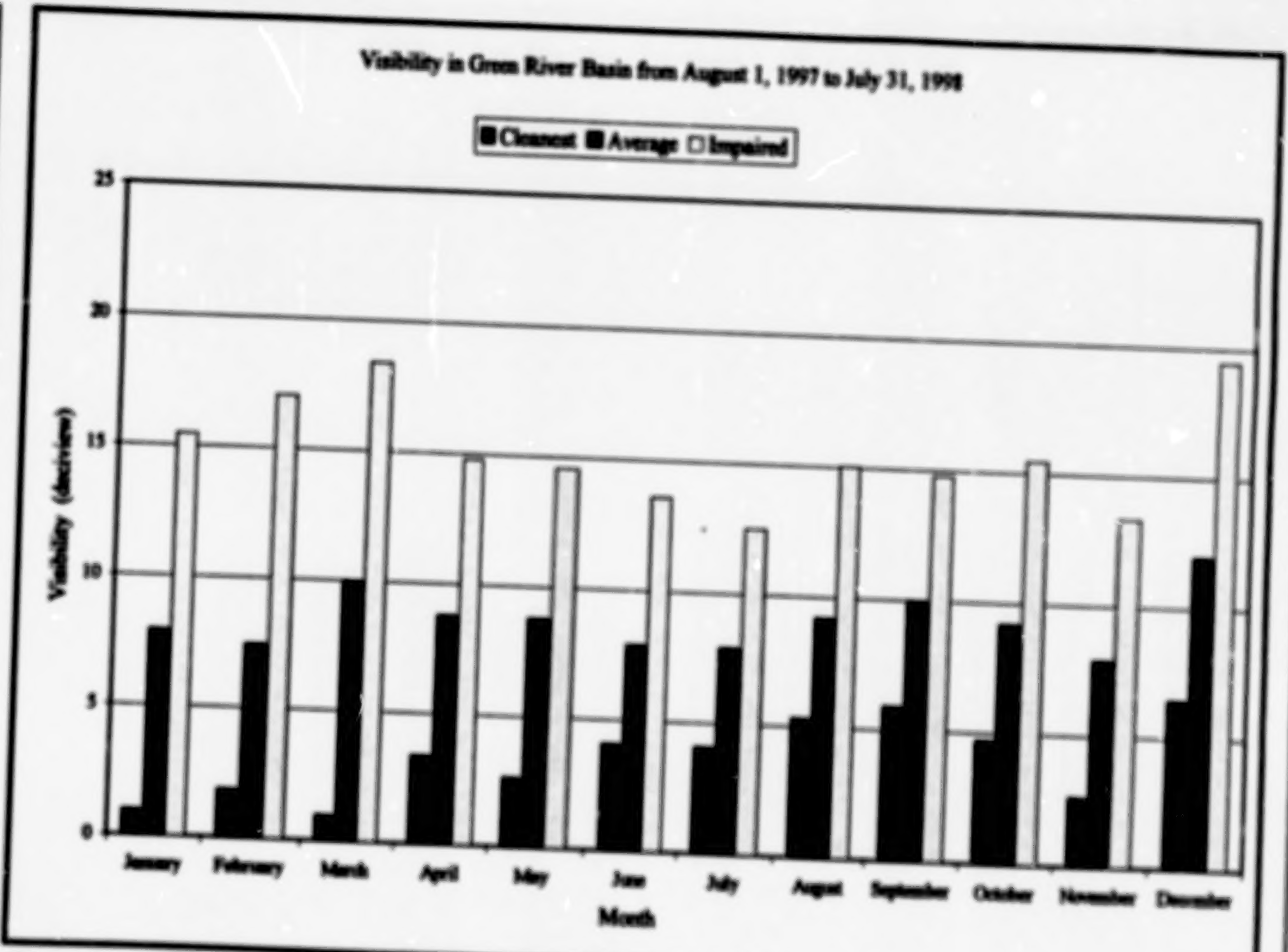


Figure 3.2 Visibility in the Green River Basin, 1997-1998.

87

saltbush, and greasewood, with occasional cottonwoods and willows along drainages. Vermillion Creek, Canyon Creek, and Alkali Creek are the major perennial streams within the VBPA. All other waterways are ephemeral, flowing in response to spring snowmelt and runoff from storm events. Drainage is into the Little Snake River, a tributary of the Green River and, in turn, the Colorado River.

3.1.4 Geology and Geological Hazards

The VBPA is generally situated in the Green River Basin, with a small portion at the northeastern boundary in the Washakie Basin (Collentine et al. 1981). These basins are separated by the Rock Springs uplift--a broad, elliptical anticline. The Washakie Basin is a structural and topographic basin having roughly a square bowl shape with an outward facing escarpment developed on the Laney Shale Member of the Green River Formation (Geo/Resource Consultants 1984). The Green River Basin is a large structural and topographic basin defined by a series of escarpments formed by tilted beds of the Green River and Wasatch Formations.

The surficial geology of the VBPA is primarily composed of deposits of Tertiary sedimentary rocks (Love and Christiansen 1985). The predominant Tertiary surficial rocks are from the Tipton Shale, the Luman Tongue, and the Wilkins Peak Member of the Eocene Green River Formation and the Cathedral Bluffs Tongue, Niland Tongue, and main body of the Eocene Wasatch Formation. The Tipton Shale consists of oil shale and marlstone, whereas the Luman Tongue consists of oil shale, carbonaceous shale, and sandstone. The Wilkins Peak Member is composed of green, brown, and gray tuffaceous sandstone, shale, and marlstone and evaporites in subsurface sections. The Cathedral Bluffs Tongue is variegated claystone with lenticular sandstone, and the Niland Tongue consists of brown sandstone, carbonaceous shale, and coal.

The VBPA is underlain by rocks of Tertiary, Cretaceous, Jurassic, Triassic, and older ages (see Figure 2.3), including the Mesaverde (Almond), Entrada and Nugget Groups--the primary formations targeted for natural gas production. Geological formations would not be affected by the proposed project and are not discussed further in this EA.

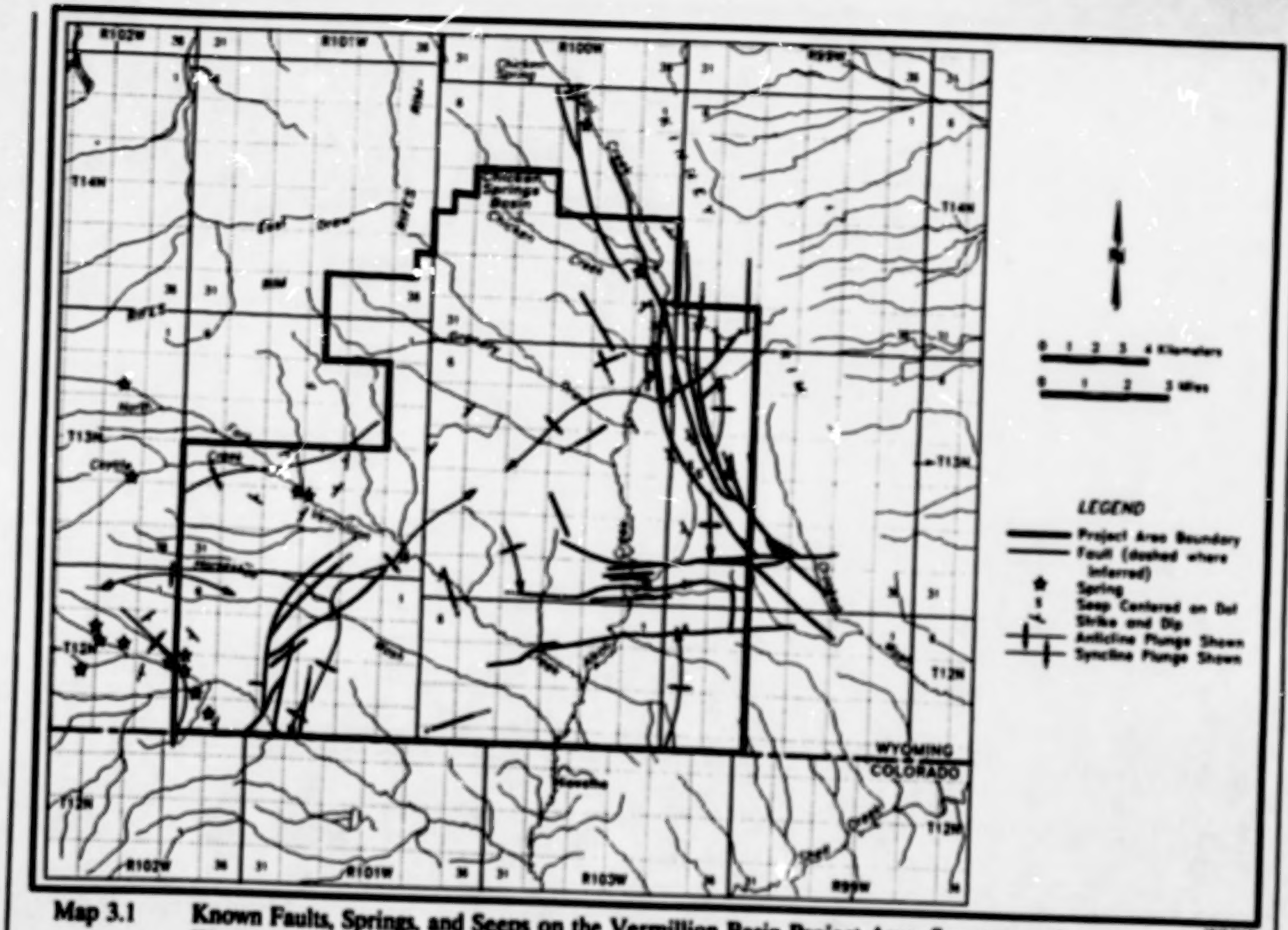
Geologic hazards within the VBPA include landslide areas (e.g., blockslides, multiple slumps, and flows), abandoned coal mines, earthquakes, and faults. The landslide areas are located primarily in the Pine Mountain Management Area in the southwestern portion of the VBPA. Three known exploratory coal mines are located in the southern portion of the VBPA, and the potential exists for subsidence from these abandoned mines (personal communication, April 2000, with James Case, Wyoming Geological Survey).

Approximately 31 earthquakes, ranging in magnitude from 2.2 to 5.3 (Case 1999) were recorded in Sweetwater County between 1888 and 1995. One of the earthquakes had its epicenter in the vicinity of the VBPA (T12N R102W) (Case et al. 1995). The most recent (and largest) earthquake, occurred on February 3, 1995. Its epicenter was near Little America, Wyoming, and it was felt in Rock Springs, Wyoming, and Salt Lake City, Utah. The quake had a magnitude of 5.3 and an intensity of V and was associated with the collapse of a 3,000-ft wide by 7,000-ft long section of a trona mine operated by Solvay Minerals, Inc. The quake killed one miner (Case 1999).

Several faults occur within the VBPA; however, although they have been recurrently active in the past 20 million years, activity is poorly defined or nonexistent in recent (Quaternary) times (Case et al. 1995). Known faults in the area are shown on Map 3.1.

3.1.5 Paleontological Resources

The BLM has established categories (Conditions 1-3) for ranking areas based on their potential to contain fossils of scientific interest. Ranking categories determine the need for



Map 3.1 Known Faults, Springs, and Seeps on the Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

additional treatment during environmental review. The BLM conditions used to define the paleontologic potential of geologic deposits in this investigation are as follows.

Condition 1. Areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. Consideration of paleontological resources will be necessary if the field office review of available information indicates that such fossils are present in the area.

Condition 2. Areas with exposures of geological units or settings that have a high potential to contain vertebrate fossils or noteworthy occurrences of invertebrates or plant fossils. The presence of geologic units from which such fossils have been recovered elsewhere may require further assessment of these same units where they are exposed in the area of consideration.

Condition 3. Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils based on their surficial geology or the presence of igneous or metamorphic rocks, extremely young alluvium, colluvium, or aeolian deposits, or deep soils. However, if possible, bedrock depth should be estimated to determine if fossiliferous deposits may be uncovered during surface disturbance.

U.S. Geological Survey (USGS) and Wyoming Geological Survey maps document the presence of Eocene sedimentary deposits within the study area (Love and Christiansen 1985; Love et al. 1993; Roehler 1973a, 1973b, 1974a, 1974b, 1978a, 1978b, 1985; Root et al. 1973). These deposits include the Green River Formation (Wilkins Peak Member, Luman Tongue, and Tipton Tongue) and the Wasatch Formation (Cathedral Bluffs, Niland Tongue, and Main Body). All of these units have produced important vertebrate fossils of Eocene age. The paleontology report (EVG and TRC Mariah Associates Inc. 2000) would be used to classify lands within the study area and to develop appropriate mitigation as needed.

3.1.6 Mineral Resources

The Vermillion Basin area has seen oil and gas drilling and production since the 1940s in portions of the Canyon Creek, Trail, and Kinney Rim field units. One hundred fifty-four wells have been drilled to date, 72 of which have been plugged and abandoned. The remaining 82 wells produced approximately 27,365 bbl oil and 1,000 mmcf of gas in 1998, and 1.85 million bbl of oil and 411,700 mmcf of gas have been produced since drilling began (WOGC 1999).

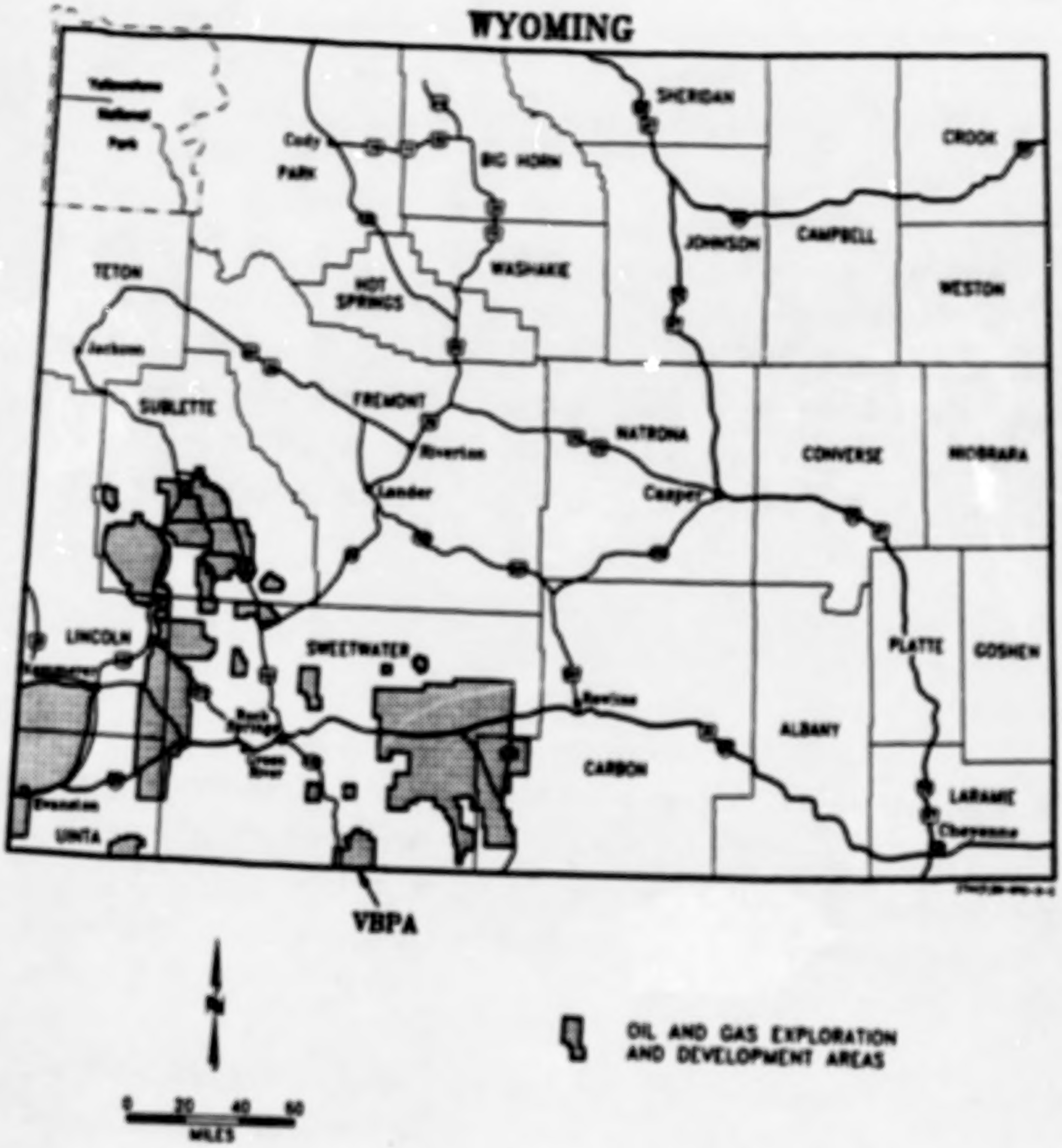
A considerable amount of oil and gas exploration and development is occurring in southwestern Wyoming and northwestern Colorado (Map 3.2). Other major oil and gas development areas in Sweetwater County include the Continental Divide/Wamsutter II, Mulligan Draw, Fontenelle, and Dripping Rock/Cedar Breaks fields. Existing oil and/or gas fields to the south of the VBPA in Colorado include the Hiawatha, Hiawatha West, Irish Creek, Shell Creek, and the Sugar Loaf fields. It is anticipated that oil and gas development and production activities will continue for more than 50 years into the future.

The Green River Coal Region covers all of Sweetwater County; however, the potential for coal development in the VBPA is low because coal beds are thin and of limited quality and/or quantity. There is no coal, zeolite, oil shale, or trona development within the VBPA.

Potential mineral development in or in the vicinity of the VBPA includes gravel and zeolite--a mineral used in water treatment, control of odor in stockyards, and for kitty litter (personal communication, April 2000, with Dave Valenzuela, BLM, Rock Springs).

3.1.7 Soils

A broad soil survey (BLM 1979) has been completed for the area; however, because adequate field verifications have not been completed, only general inferences can be made. Soils within the VBPA are generally found on three geomorphic positions: 1) dissected uplands; 2) topographic breaks associated with drainages; and 3) narrow floodplains. Most



Map 3.2 **Southwestern Wyoming Oil and Gas Development Areas.**

upland soils and breaks are associated with, and derived from, the Green River Formation (Wilkins Peak member) and Wasatch Formation (Niland Tongue) interbedded siltstone, sandstone, mudstone, limestone, and shale.

A cursory assessment of erosion within the project area suggests that most accelerated soil loss has occurred where roads and pipelines cross drainages in Sections 21, 22, and 23, T12N, R100W--the southeast portion of the project area along the Colorado border (personal communication, February 2000, John McDonald, BLM, Rock Springs, Wyoming). Incised drainages are common, but most uplands are relatively stable except for slopebreaks above drainages. Additional soil disturbance is associated with deep rutting adjacent to existing roads caused by traffic either sliding off roads or intentionally driving off-road to avoid poor road surfaces when wet conditions exist.

In general, soils in the VBPA are well drained and less than 40 inches deep (depth to bedrock); have loam, silt loam, clay loam, and silty clay loam textures; and have high salinity and/or alkalinity. Sandy loam soils may be associated with sandstone outcrops but are relatively uncommon. Soils often have gravels and fractured shale and sandstone (channers) within their matrix. Vegetation on these soils includes Gardner's saltbush, Indian ricegrass, bottlebrush squirreltail, western wheatgrass, bluegrasses, and greasewood. Slopes are generally 2-8%, although steeper slopes of 20-30% are found at drainages and in proximity to rock outcrop ridges.

Loam and fine sandy loam soils with bedrock greater than 40 inches deep and with less salinity are common in swales and on the leeside of ridges. Vegetation is dominated by big sagebrush, western wheatgrass, thickspike wheatgrass, basin wildrye, and bluegrasses. Clay loam soils on alluvial fans are found near the base of Kinney Rim and in the Canyon Creek area near WY-430. Deposits of terrace gravels are scattered along the alluvial fans at the base of Kinney Rim.

The limiting physical and chemical characteristics on many of these upland soils are high salt and silt content. When disturbed, these soils have a high potential for water erosion and may have low weight-bearing strength for well pads and roads.

Slope breaks are associated with Vermillion Creek, Horseshoe Wash, Alkali Creek, and Canyon Creek and are characterized by steep sideslopes and rock escarpments with gradients of 25-100%. In Sections 21, 22, and 23, T12N, R100W--the southeast part of the project area--these breaks are associated with the Green River Formation (Lumen Tongue) and consist of interbedded shale, sandstone, siltstone, and mudstone. Soils on these slopes are generally less than 20 inches deep with textures of sandy loam intermingled with silty clay loam. These well drained soils frequently have high alkalinity and a severe water erosion potential. Vegetation is commonly Gardner's saltbush, bottlebrush squirreltail, Indian ricegrass, and greasewood.

Soils on floodplains and bottomlands are dominated by silt loams and silty clay loams, generally do not have bedrock within 60 inches of the surface, are poorly to well-drained, and commonly have high salinity and/or alkalinity. Seasonally high water tables and seasonal flooding may be present in the VBPA. Slopes are 0-2% except in areas of headcutting. These soils have moderate to high water erosion potential if the vegetation is removed. Vegetation includes greasewood, basin wildrye, Indian ricegrass, bottlebrush squirreltail, and Gardner's saltbush. Big sagebrush occurs in areas with lower alkalinity.

3.1.8 Water Resources

3.1.8.1 Surface Water

The VBPA is contained within the 616,301 acre (963 mi^2) Vermillion Watershed. Drainage is to the Colorado River via the Little Snake and Green Rivers. The project area contains eight tributary watersheds: Vermillion Creek, Alkali Creek, Horseshoe Wash, Canyon

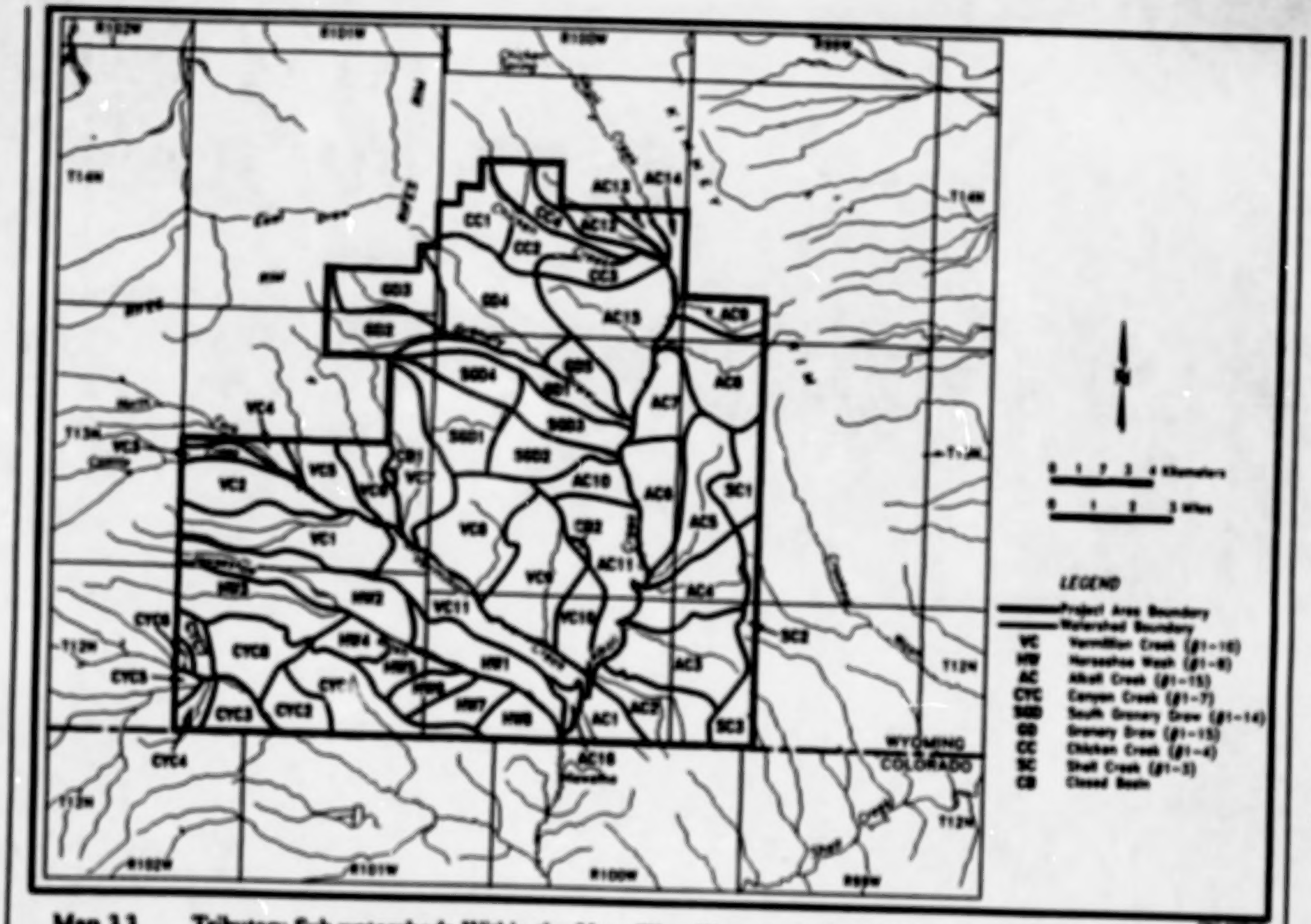
Creek, Granery Draw, South Granery Draw, Chicken Creek, and Shell Creek (Map 3.3). Within each tributary watershed are sub-watersheds that range in size from 384 to 3,290 acres (Table 3.2). Two closed basins are also present.

Surface water resources in the VBPA include perennial, intermittent, and ephemeral streams as well as livestock ponds, small detention reservoirs, seeps, and springs. Known springs and seeps in the area are shown on Map 3.1.

Eight springs and four seeps are known to occur within the project area, and an additional nine springs occur within 3 mi of the VBPA (see Map 3.1) (Roehler 1985; personal communication, 2000, with Gus Winterfeld, Professional Geologist). Springs are associated with Chicken Creek, Coyote Creek, and a tributary to Canyon Creek in the southwest; the one spring and four seeps in the eastern portion of the project area are not associated with surface water features (see Map 3.1).

Most spring and seep locations are strongly correlated with surface geology. Sixteen of the 17 springs occur within the Wilkens Peak Member of the Green River Formation. The other spring occurs in the Luman Tongue of the Green River Formation, and the four seeps occur in the Niland Tongue of the Wasatch Formation.

Perhaps more important than the apparent correlation of springs/seeps with surface geology, is an additional correlation with geologic structure. The four springs and four seeps in the eastern and northern portions of the VBPA are associated with a major northwest/southeast-trending fault system, so the springs are likely fed by ground water flow in faulted rocks in the Wasatch Formation and the Wilkens Peak Member. Given the extensive fault system, the reservoirs feeding the springs are probably large. In the western portion of the project area, eleven of the 13 springs are associated with synclines (large folds whose limbs are higher than their centers) developed in the Wilkens Peak Member. The Wilkens Peak Member is composed of interbedded oil shale, mudstone, claystone, limestone,



Map 3.3 Tributary Sub-watersheds Within the Vermillion Watershed, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

97

Table 3.2 Acreages of Tributary Sub-watersheds Within the Vermillion Watershed, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

Tributary/ Sub-watershed	Acres Within VBPA	% of VBPA (92,490 acres)	% of the Vermillion Watershed (616,301 acres)
Vermillion Creek			
VC-1	3,289.5	3.56	0.53
VC-2	2,195.1	2.37	0.36
VC-3	473.6	0.51	0.08
VC-4	550.4	0.60	0.09
VC-5	1,260.8	1.36	0.20
VC-6	1,075.2	1.16	0.17
VC-7	2,316.7	2.50	0.38
VC-8	3,071.9	3.32	0.50
VC-9	3,219.1	3.48	0.52
VC-10	1,145.6	1.24	0.19
VC-11	2,732.7	2.95	
Subtotal	21,330.6	23.06	3.46
Alkali Creek			
AC-1	998.4	1.08	0.16
AC-2	2,195.1	2.37	0.36
AC-3	3,001.5	3.25	0.49
AC-4	2,284.7	2.47	0.37
AC-5	2,419.1	2.62	0.39
AC-6	2,047.9	2.21	0.33
AC-7	1,465.5	1.58	0.24
AC-8	2,643.1	2.86	0.43
AC-9	998.4	1.08	0.16
AC-10	1,004.8	1.09	0.16
AC-11	2,790.3	3.02	0.45
AC-12	1,107.2	1.20	0.18
AC-13	384.0	0.42	0.06
AC-14	729.6	0.79	0.12
AC-15	3,660.7	3.95	0.59
AC-16	294.4	0.32	0.05
Subtotal	28,024.7	30.30	4.55
Horseshoe Wash			
HW-1	2,195.1	2.37	0.36
HW-2	3,065.5	3.31	0.50
HW-3	2,931.1	3.17	0.48
HW-4	812.8	0.88	0.13
HW-5	812.8	0.88	0.13
HW-6	736.0	0.80	0.12
HW-7	1,030.4	1.11	0.17
HW-8	1,036.8	1.12	0.17
Subtotal	12,620.5	13.65	2.05

Table 3.2 (Continued)

Tributary/ Sub-watershed	Acres Within VBPA	% of VBPA (92,490 acres)	% of the Vermillion Watershed (616,301 acres)
Canyon Creek			
CYC-1	2,310.3	2.50	0.37
CYC-2	1,075.2	1.16	0.17
CYC-3	902.4	0.98	0.15
CYC-4	512.0	0.55	0.08
CYC-5	249.6	0.27	0.04
CYC-6	172.8	0.19	0.03
CYC-7	550.4	0.60	0.09
CYC-8	550.4	0.60	0.09
Subtotal	6,323.1	6.84	1.03
Granary Draw			
GD-1	1,465.5	1.58	0.24
GD-2	1,638.3	1.77	0.27
GD-3	1,663.9	1.80	0.27
GD-4	3,827.1	4.14	0.62
GD-5	953.6	1.03	0.15
Subtotal	9,548.4	10.32	1.55
South Granary Draw			
SGD-1	2,195.1	2.37	0.36
SGD-2	1,638.3	1.77	0.27
SGD-3	1,465.5	1.58	0.24
SGD-4	1,273.6	1.38	0.21
Subtotal	6,572.5	7.11	1.07
Chicken Creek			
CC-1	1,465.5	1.58	0.24
CC-2	1,171.2	1.27	0.19
CC-3	953.6	1.03	0.15
CC-4	1,248.0	1.35	0.20
Subtotal	4,838.3	5.23	0.79
Shell Creek			
SC-1	1,465.5	1.58	0.24
SC-2	729.6	0.79	0.12
SC-3	819.2	0.89	0.13
Subtotal	3,014.3	3.26	0.49
Closed Basin			
CB-1	70.4	0.08	0.01
CB-2	147.2	0.16	0.02
Subtotal	217.6	0.24	0.04
Total	92,490	100	15.01

algal limestone, and sandstone of varying permeabilities–impermeable beds may act as aquitards which may allow the syncline to direct water down-dip to the springs, so these springs may be fed by infiltrated water from precipitation events (i.e., recharge from local outcrops). These synclines are relatively small (occupying only a few square miles at the surface) and thus, the reservoirs feeding the springs may be small.

Principal drainages include Alkali Creek, Vermillion Creek, and Canyon Creek–all perennial streams (USFWS 1991). Stream flow in Vermillion Creek near Hiawatha, Colorado, ranged from 1 cubic foot per second (cfs) to 196 cfs from 1979-1981 (http://waterdata.usgs.gov/nwis-w/US/search.cgi). Other streams within the VBPA include Horseshoe Wash, Granery Draw, Coyote Creek, and Chicken Creek, all of which are ephemeral (USFWS 1991) (i.e., they generally flow in the spring in response to snowmelt and at other times of the year in response to precipitation events).

Surface water quality data for the VBPA are limited; however, nine stream reaches were assessed for proper functioning condition (PFC) by the BLM in 1994 and 1999 as outlined in BLM (1998b). PFC is defined as the minimum acceptable standard for stream function and is the result of interaction among geology, soil, water, and vegetation. Riparian/wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to accomplish the following:

- dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality;
- filter sediment, capture bedload, and aid floodplain development;
- improve flood-water retention and ground water recharge;
- develop root masses that stabilize streambanks against cutting action;
- develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and
- support biodiversity.

Assessments revealed that the majority of the Vermillion Creek drainage is in an apparent upward trend; however, other creeks in the area do not share this rating and are functioning-at-risk (FAR) (Table 3.3). Areas designated as FAR are at less than minimal functional conditions because existing soil, water, or vegetation attributes make them susceptible to degradation. Irrigation, channel modification, and ranching activities on private land in the vicinity of the drainages are believed to be the primary contributing factors to the FAR ratings.

The North Fork Vermillion Creek is a Class 3 water--an important trout fishery of regional importance (WGFD 1991)--and supports a population of brook trout. In 1998 total alkalinity in the North Fork of Vermillion Creek was recorded as 225 parts per million (ppm), total hardness as 190 ppm, and conductivity as 380 micro-ohms per centimeter (personal communication, March 2000, with Ron Remmick, WGFD, Green River). The remaining streams in the project area are rated as Class 5 waters--low production waters often incapable of sustaining a trout fishery.

3.1.8.2 Ground Water

The main body of the Wasatch Formation is an important aquifer in both the Green River and Washakie basins. Most useable ground water (i.e., <5,000 ppm total dissolved solids [TDS]) within the VBPA occurs through the Wasatch Formation or to the top of the Fort Union Formation (ranging from about 1,000 to 3,650 ft below the surface), except where faulting disrupts ground water flow. In faulted areas, useable water generally extends only a few hundred feet below the surface. The Green River Formation, which overlays the Wasatch Formation, is a confining unit with discontinuous aquifers (Collentine et al. 1981). Sandstones are the predominant water-bearing rocks, and properties of individual aquifers are highly variable depending on aquifer thickness, grain size and shape, sorting, and the areal extent of the aquifer. All of these factors affect the ability of an aquifer to store and transmit water.

Table 3.3 Functioning Condition of Streams in the Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

Stream Reach (Location)	Allotment	Rating[1] (miles)					Total (miles)
			FAR				
		PFC	Upward	Stable	Downward	NF	
Alkali Creek (Chicken Springs to County Road 19)	Vermillion Creek/Alkali Creek	5.00					5.00
Alkali Creek (T13N, R100W, Sec. 1 to confluence with Vermillion Creek)	Vermillion Creek/Alkali Creek/ Crooked Wash		8.00				8.00
Alkali Creek (T13N, R103W, Sec. 16)	Pine Mountain			1.00			1.00
Alkali Creek (below State Highway 40 to confluence with Salt Wells Creek)	Pine Mountain			1.50			1.50
Canyon Creek (G-Basin and two short reaches)	Pine Mountain				2.00		2.00
Canyon Creek (small segment below canyon)	Pine Mountain		0.25				0.25
Canyon Creek (mid canyon)	Pine Mountain		0.90			0.10	1.00
Canyon Creek (lower canyon)	Pine Mountain		0.35		0.15		0.50
Canyon Creek (lower 4-J Basin)	Pine Mountain			0.40		0.60	1.00
Coyote Creek (top of mountain to Scofield Ranch)	Pine Mountain				6.00		6.00
Coyote Creek (just above Vermillion Creek confluence)	Pine Mountain		1.00				1.00
Coyote Creek (Scofield Ranch to sorting pens)	Pine Mountain			1.00			1.00
Vermillion Creek (Wallace Cabin to bridge)	Pine Mountain				3.50		3.50
Vermillion Creek (below Rife Ranch)	Pine Mountain			1.00			1.00
Vermillion Creek (bridge to Rife Ranch)	Pine Mountain				3.00		3.00
Vermillion Creek (timber above Wallace Cabin)	Pine Mountain	1.00					1.00
Vermillion Creek (below Highway 30)	Vermillion Creek		8.50				8.50

[1] PFC = proper functioning condition; FAR = functioning-at-risk; NF = non-functioning.

The primary source of recharge for aquifers in the VBPA is infiltration of snowmelt and runoff water where formations outcrop at the surface, and from downward seepage from overlying layers (Welder and McGreevy 1966). Discharge occurs primarily in surface playas, streams, and springs, especially along existing drainages.

Ground water quality is highly variable and depends on the chemical properties of the supplying aquifer, the distance from the aquifer recharge area, the degree of seepage into an aquifer from other formations, and the degree of faulting (personal communication, April 2000, with Dave Valenzuela, BLM, Rock Springs).

3.1.9 Noise and Odor

Undeveloped portions of the VBPA likely have background noise levels similar to the EPA's category of "Farm in Valley" (EPA 1971). Wind, thunderstorms, livestock, and wildlife are the primary non-human-caused sources of noise within the VBPA, and outdoor noise levels generally range from 39 A-weighted decibels (dBA) during the day to 32 dBA at night (BLM 1999b). Quiet noises are generally less than 60 dBA, moderately loud noises range from 60 to 90 dBA, and loud noises are generally greater than 90 dBA.

The primary human-caused noises in the VBPA are associated with the exploration and production of natural gas from construction, drilling, completion, and production operations and from associated traffic. Recreational activities also contribute noise. No specific noise level data are available for the VBPA; however, the noise impact from a typical drill rig for Wyoming gas drilling is approximately 63 dBA at 200 ft from the rig. Noise from a 26,000-hp compressor is approximately 78 dBA at 200 ft (BLM 1999b). The Draft Pinedale Anticline EIS Technical Report (BLM 1999c) reported that the noise level at approximately 2,000 ft from a drill rig was 39 dBA, or equal to median ambient noise levels. Noise levels from a 26,000-hp compressor approached the median ambient noise levels of 37 dBA at approximately 5,000 ft.

Other studies indicate drilling and well testing operations produce noise levels ranging from 78 dBA to 115 dBA at the source (BLM 1991b, 1999c). Noise levels associated with construction activities range from 70 dBA to more than 90 dBA at 50 ft. Flaring operations, which last for only 2-3 days per well, likely produce the loudest noises. Flaring operations producing 98 dBA at the source attenuated to 66 dBA at 0.1 mi and drilling operations producing 78 dBA at the source attenuated to 50 dBA at 0.25 mi in south-central Wyoming (BLM 1999c). Noise levels attenuate with distance at a rate of approximately 6 dBA with each doubling of distance (Thumann and Miller 1986).

Noise-sensitive receptors in the VBPA include sage grouse leks and nesting areas during the breeding and nesting seasons, occupied raptor nests, and antelope winter ranges. There are no noise standards for these noise-sensitive areas.

No specific data on odors are available from the VBPA; however, odors present in the area, other than the natural odors of vegetation and wildlife, are likely associated with vehicle emissions along roads, natural gas development operations at well locations and ancillary facilities, and livestock concentration areas. Odors in the area are likely to be quickly dispersed by the wind.

3.2 BIOLOGICAL RESOURCES

3.2.1 Vegetation and Wetlands

This description of vegetation resources within the Vermillion Basin is based on the area biologist's extensive personal knowledge of the project area (personal communication, February 2000, Jim Dunder, BLM, Rock Springs, Wyoming) and the review of orthophoto quad maps, grazing allotment maps, and the field office LANDSAT imagery with computer enhancement.

The Vermillion Basin is located within the Sagebrush Steppe biome where greasewood, big sagebrush, and saltbush are common components. High elevations, thin alkaline soils, long cold winters, and low annual precipitation are prime determinants of the plant species composition, abundance, and distribution. The Wyoming big sagebrush/saltbush plant community comprises about 41% of ground cover in the VBPA. Vegetation includes Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), spiny hopsage (*Grayia spinosa*), Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), Indian ricegrass (*Oryzopsis hymenoides*) and thickspike wheatgrass (*Agropyron dasystachyum*). This plant community seldom exceeds 24 inches in height and is commonly found on benches and upper valley slopes of drainages. It provides forage for livestock and big game and is important in providing nesting cover for sage grouse.

Approximately 36% of the VBPA is located within the Gardner's saltbush (*Atriplex gardneri*) plant community. This is a low-growing windblown plant community of generally low density. Other associated plants may include bud sagebrush (*Artemisia spinescens*), winterfat (*Krascheninnikovia lanata*), spiny horsebrush (*Tetradymia spinosa*), and bottlebrush squirreltail (*Sitanion hystrix*). This plant community is associated with thin, poorly developed soils on ridge tops and benches, is used by antelope and livestock, and is highly suitable for prairie dogs and mountain plover nesting.

The big sagebrush plant community occurs along ephemeral stream channels and upper tributaries and covers approximately 11% of the VBPA. It is composed of mature, decadent, and dead basin big sagebrush (*Artemisia tridentata tridentata*) and clumps of Great Basin wildrye (*Elymus cinereus*). Presence of these species suggests deeper silty soils which may be somewhat developed. Because the height of the vegetation ranges from 24 to 60 inches or more, windblown silt and snow are trapped and retain soil moisture over longer periods than do most other plant communities in the area. The big sagebrush plant community is important as escape cover for wildlife and shelter for livestock.

About 8% of the VBPA has small stands of black greasewood (*Sarcobatus vermiculatus*), which are often found in association with Great Basin wildrye (*Elymus cinereus*). Greasewood is found in the bottoms of dry washes and on steep slopes above the drainage. Black greasewood may be intermingled with some basin big sagebrush where deeper soils exist and higher salinity encourages greasewood encroachment. Greasewood often exists in a zone outside the riparian influence of perennial streams. In some places this results in a thorny barrier which may begin 8-10 ft from the stream bank and extend as much as 40 ft laterally. Cattle graze the greasewood during spring, and it provides some escape cover for wildlife. Greasewood appears to be a diminishing species in the Vermillion Basin.

Riparian habitat comprises less than 3% of vegetative cover in the VBPA. Vermillion Creek, Alkali Creek, Chicken Creek, and parts of Granery Draw contain most of the riparian habitat. Willows and cottonwoods are occasionally found along Vermillion Creek and a few scattered portions of lower Alkali Creek, but are not common or dense enough to be significant. Rushes (*Juncus* spp.) and Nebraska sedge (*Carex nebrascensis*), in association with a variety of deep rooted grasses, thistle, and forbs, characterize this plant community which occurs in the stream channel and within a sub-irrigated zone near streams, flowing wells, and springs.

The locations and types of wetlands within the VBPA were determined from USFWS Draft National Wetland Inventory maps (USFWS 1991). Seventy-nine potential palustrine wetlands were identified within the project area: 50 (63%) are seasonally flooded; 20 (25%) are temporarily flooded; seven (9%) are semipermanently flooded; and two (3%) are saturated. Most channels within the VBPA have associated riverine wetlands that are temporarily, seasonally, or semipermanently flooded. Sixteen stockponds are scattered throughout the area. Most are less than 1.0 acre in size and generally occur along ephemeral stream channels.

Small acreages of cushion plants occur on rocky rims above the main drainages, and the edges of rims and the upper reaches of steep headcuts contain scattered patches of snowberry (*Symphocarpus occidentalis*). These shrubs are often important for big game on crucial winter range.

Noxious weeds known to exist on the VBPA include Canada thistle (*Circium arvense*), perennial sowthistle (*Sonchus arvensis*), hoary cress or whitetop (*Cardaria draba* and *C. pubescens*), perennial pepperweed (*Lepidium latifolium*), Russian knapweed (*Centaurea repens*), and saltcedar (*Tamarix* spp.) (personal communication, February 2000, with Jim Cotterman, Sweetwater County Weed and Pest Control, Sweetwater, Wyoming). Table 3.4 presents the *Wyoming Weed and Pest Control Act* Designated List.

3.2.2 Wildlife and Fisheries

3.2.2.1 Big Game

Two big game species occur within or immediately adjacent to the VBPA: pronghorn and mule deer. The population estimates for big game herds provided below are based upon WGFD models and the reader is encouraged to refer to the annual big game herd unit reports (WGFD 1999) for specific information regarding these estimates. These reports are available from the WGFD in Cheyenne, Wyoming.

Pronghorn. Pronghorn in the VBPA belong to the Bitter Creek and South Rock Springs herd units. The Bitter Creek herd unit is bounded by I-80 to the north, the Colorado state line to the south, Highway 789 to the east, and WY-430 to the west. The Bitter Creek herd unit covers 1,865,408 acres and includes antelope hunt area 58 in the VBPA east of WY-430. Approximately 82,778 acres (4.4%) of this herd unit is within the VBPA (Map 3.4). Hunters contacted during routine harvest field checks over the past several years have complained about the large number of wild horses in this herd unit. The Bitter Creek Herd

Table 3.4 *Wyoming Weed and Pest Control Act* Designated List.[1]

Common Name	Scientific Name
Foxtail barley	*Hordeum jubatum*
Field bindweed	*Convolvulus arvensis*
Canada thistle[2]	*Circium arvense*
Leafy spurge	*Euphorbia esula*
Perennial sowthistle[2]	*Sonchus arvensis*
Quackgrass	*Agropyron repens*
Hoary cress (whitetop)[2]	*Cardaria draba* and *Cardaria pubescens*
Perennial pepperweed (giant whitetop)[2]	*Lepidium latifolium*
Oxeye daisy	*Chrysanthemum leucanthemum*
Skeletonleaf bursage	*Franseria discolor*
Russian knapweed[2]	*Centaurea repens*
Yellow toadflax	*Linaria vulgaris*
Dalmatian toadflax	*Linaria dalmatica*
Scotch thistle	*Onopordum acanthium*
Musk thistle	*Carduus nutans*
Common burdock	*Arctium minus*
Plumeless thistle	*Carduus acanthoides*
Dyers woad	*Isatis tinctoria*
Houndstongue	*Cynoglossum officinale*
Spotted knapweed	*Centaurea maculosa*
Diffuse knapweed	*Centaurea diffusa*
Purple loosestrife	*Lythrum salicaria*
Saltcedar[2]	*Tamarix* spp.

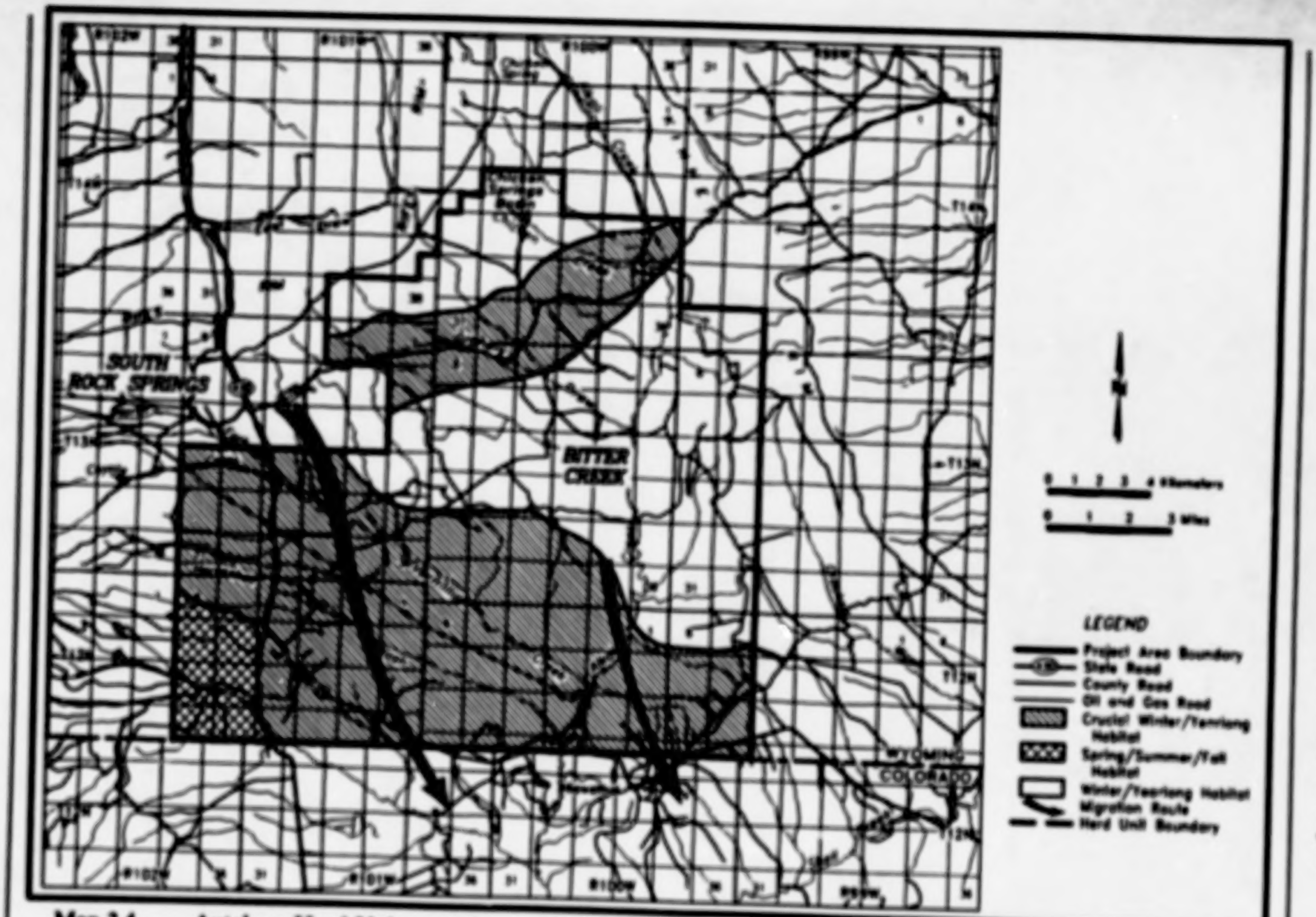
---

[1] Designated Noxious Weeds, Wyoming Statute § 11-5-102 (a)(xi) and Prohibited Noxious Weeds, Wyoming Statute § 11-12-104.

[2] Known to be present in the VBPA.

BLANK

PAGE



Map 3.4 Antelope Herd Units and Range Types, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

unit has a postseason population objective of 25,000, and a 1998 postseason estimate of about 16,000 antelope (WGFD 1999). The 5-year (1993-1997) population average was 16,260 animals (65% of objective) (WGFD 1999).

The South Rock Springs antelope herd inhabits 776,256 acres south of I-80 and east of Flaming Gorge Reservoir to WY-430. Approximately 9,712 acres (1.2%) of this herd unit is within the VBPA west of WY-430 in antelope hunt area 112. The WGFD population objective for this herd is 8,000 animals, and the estimated end-of-year population in 1998 was 5,200, or 65% of objective. The 5-year (1993-1997) population average was 4,260 animals (53% of objective) (WGFD 1999).

Approximately 55.6% of the VBPA (51,424 acres) is considered pronghorn crucial winter/yearlong range--45,782 acres are in the Bitter Creek herd unit and 5,642 acres are in the South Rock Springs herd unit (see Map 3.4). Crucial winter/yearlong range is defined as winter/yearlong range that has been documented by the WGFD as the determining factor in the ability of a big game population to maintain itself at the population objective over the long term (WGFD no date [n.d.]). Approximately 40.0% (36,996 acres) of the VBPA is winter/yearlong habitat within the Bitter Creek herd unit. Winter/yearlong range is that range of which a portion is used yearlong, but during winter (December 1 to April 30) has a significant influx of animals from other seasonal ranges (WGFD n.d.). The remaining 4.4% (4,070 acres) of the VBPA is spring/summer/fall range in the South Rock Springs herd unit. Spring/summer/fall range is used from about May 1 to November 30. This range type is unable to support a big game population during persistent winter conditions (WGFD n.d.).

Mule Deer. Mule deer in the VBPA belong to the South Rock Springs herd (hunt areas 101 and 102). This herd unit encompasses the area south of I-80 to the Colorado line/between Flaming Gorge Reservoir and the Bitter Creek Road. The current population objective for this herd is 11,750, and the estimated population for 1998 was 7,000 or 60%

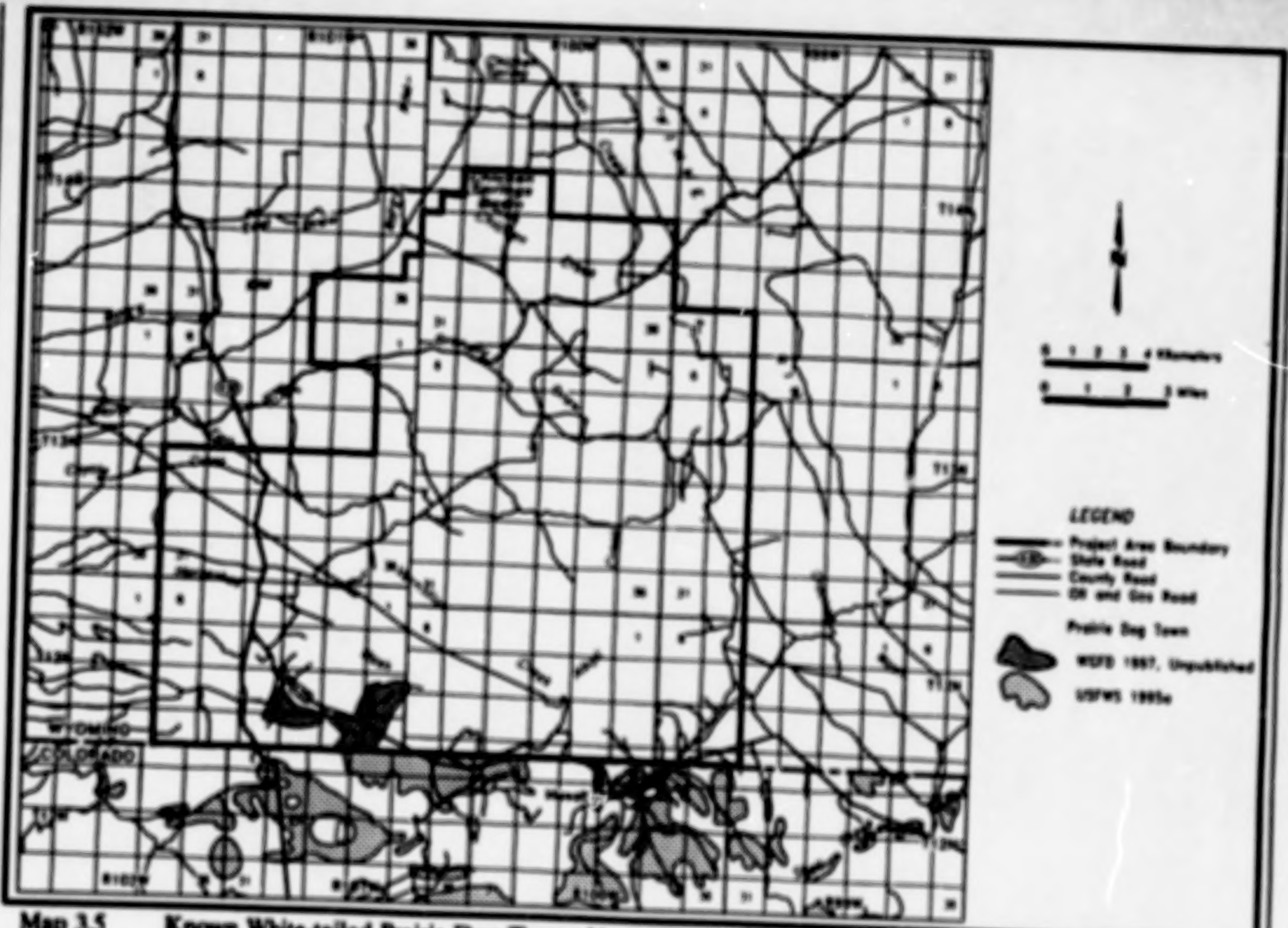
of objective. The estimated 5-year average population (1993-1997) for this herd was 5,900 (50% of objective) (WGFD 1999).

The primary management concern for the South Rock Springs herd has been the low recruitment rate. It is possible that the cumulative impacts of habitat degradation and/or succession, interspecific competition, and human developments such as Flaming Gorge Reservoir have contributed to this relatively low recruitment. To address this problem, the WGFD has recently undertaken a multi-year habitat improvement project. It appears that fawn production and survival have improved over the last 4 years, primarily as a result of favorable weather and forage conditions (WGFD 1999).

The entire VBPA is considered winter/yearlong mule deer range. The nearest crucial winter/yearlong mule deer range is approximately 1 mi northwest of the VBPA boundary.

3.2.2.2 Other Mammals

Predators known to occur or to potentially occur in the VBPA are coyote, red fox, raccoon, ermine, long-tailed weasel, badger, western spotted skunk, striped skunk, mountain lion, and bobcat (Clark and Stromberg 1987; WGFD 1992). Lagomorph species include desert cottontail, mountain (Nuttall's) cottontail, and white-tailed jackrabbit. Squirrels known to occur or to potentially occur include least chipmunk, Wyoming ground squirrel, golden-mantled ground squirrel, thirteen-lined ground squirrel, and white-tailed prairie dog (Map 3.5) (Clark and Stromberg 1987; WGFD 1992). Other rodents include two species of pocket gopher (Wyoming and northern), three species of pocket mouse (olive-backed, silky, and Great Basin), Ord's kangaroo rat, beaver, canyon mouse, white-footed mouse, deer mouse, pinon mouse, northern grasshopper mouse, bushy-tailed woodrat, four species of vole (long-tailed, montane, meadow, and sagebrush), muskrat, two species of jumping mouse (meadow and western), and porcupine. Several species of shrews (masked, Merriam's dusky,



Map 3.5 Known White-tailed Prairie Dog Towns, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

112

and dwarf) and bats (California, western small-footed, long-eared, little brown, long-legged myotis, hoary, silver-haired, big brown, Townsend's big-eared, and pallid) may also occur.

3.2.2.3 Raptors

Raptor species known to nest on or adjacent to the VBPA include short-eared owls, American kestrel, Swainson's hawk, ferruginous hawk, red-tailed hawk, northern harrier, golden eagle, burrowing owl, and great horned owl (Dorn and Dorn 1990). Other raptor species may occur as wintering populations or migrants, including rough-legged hawk and prairie falcon. Raptor nesting surveys have not been completed on the VBPA; however, approximately 75 nests are known to occur in and adjacent to project area (Map 3.6) (BLM 2000).

3.2.2.4 Upland Game Birds

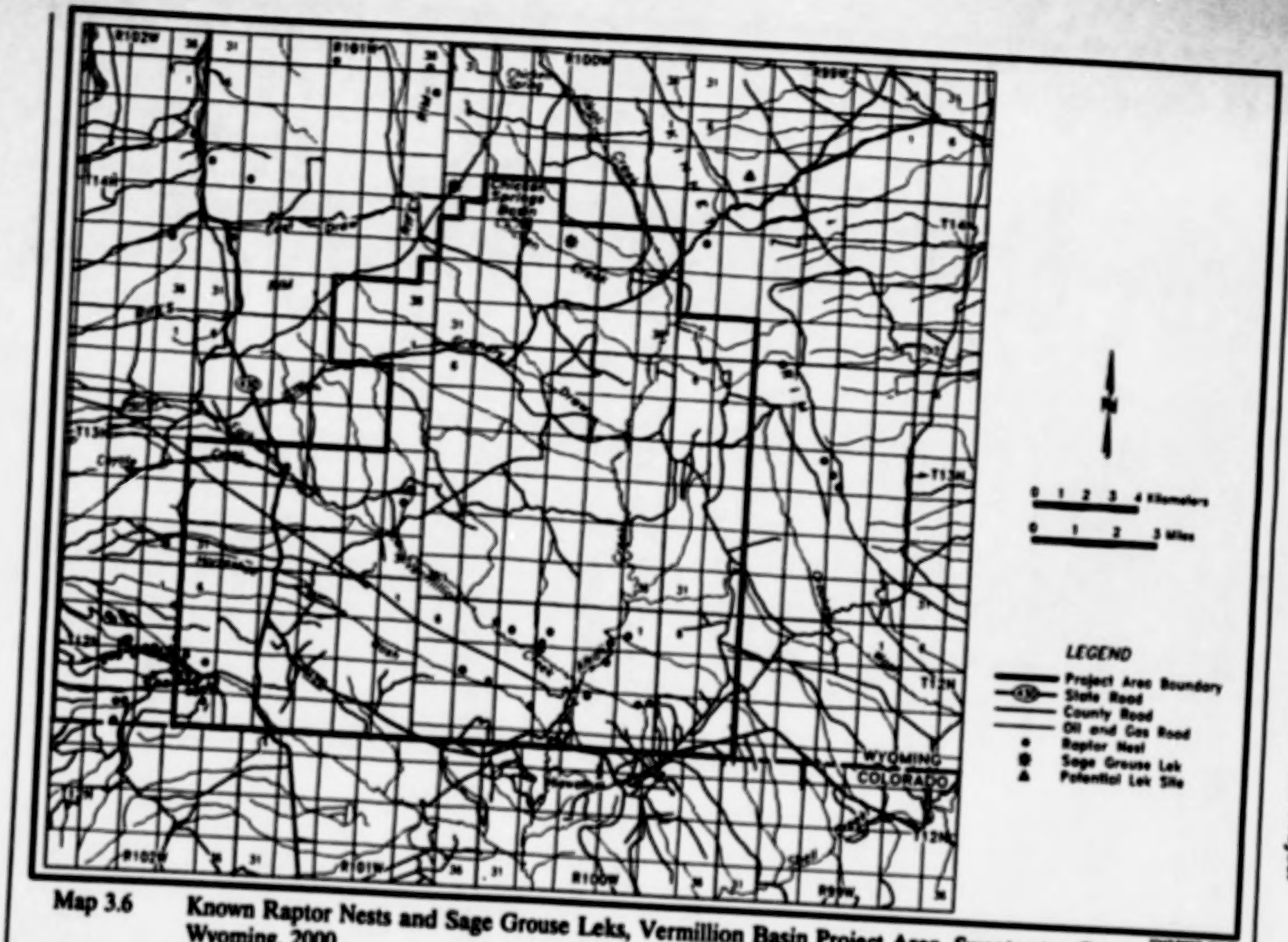
The entire VBPA is contained within upland game bird management area number 6. Two upland game bird species--sage grouse and mourning dove--occur on and adjacent to the VBPA.

Sage Grouse. Three leks/potential leks have been identified on or adjacent to the VBPA (see Map 3.6) and the area was inventoried to identify lek locations in 2000. Suitable nesting, brood-rearing, and wintering habitats are also present on the area in big sagebrush-dominated habitats.

Mourning Dove. Mourning dove concentrations are usually highest near power lines, buildings, and other areas of human disturbance, and these habitats are uncommon in the VBPA. Therefore, doves that do populate the VBPA likely utilize shrub-covered areas along washes and dunes that provide suitable cover for nesting and roosting.

BLANK

PAGE



Map 3.6 Known Raptor Nests and Sage Grouse Leks, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

114

3.2.2.5 Other Birds

Bird species potentially occurring within the VBPA, based upon range and habitat preference, include common nighthawk, Say's phoebe, western kingbird, horned lark, swallows (e.g., violet-green, barn, cliff), black-billed magpie, common raven, American crow, rock wren, mountain bluebird, loggerhead shrike, Brewer's sparrow, vesper sparrow, savannah sparrow, sage sparrow, lark bunting, McCown's longspur, red-winged blackbird, western meadowlark, Brewer's blackbird, common grackle, green-tailed towhee, and brown-headed cowbird (Scott 1987; WGFD 1992). Several species of wading/shore birds and waterfowl may occasionally occur along Canyon, Vermillion, and Alkali Creeks and within and around seasonal ponds/lakes within the VBPA. Wading/shore birds likely to occur include great blue heron, black-crowned night-heron, American avocet, willets, killdeer, and spotted sandpiper. Waterfowl species likely to occur include eared grebe, American coot, Canada goose, mallard, green-winged teal, northern pintail, blue-winged teal, northern shoveler, gadwall, American wigeon, and common merganser.

3.2.2.6 Amphibians and Reptiles

Based on range and habitat preference, two amphibian and six reptile species are likely to occur within the VBPA (Baxter and Stone 1985). Amphibians include tiger salamander and Great Basin spadefoot, which occur primarily in and adjacent to aquatic habitats. Reptile species include northern sagebrush lizard, eastern short-horned lizard, northern plateau lizard, Great Basin gopher snake, wandering garter snake, and prairie rattlesnake (personal communication, April 2000, with Andrea Cerovski, WGFD, Lander, Wyoming).

3.2.2.7 Fisheries

Perennial streams on the VBPA are limited to Vermillion, Canyon, and Alkali Creeks. One section of the North Fork of Vermillion Creek, located just upstream from the northwestern project boundary, is a WGFD Class 3 water--an important trout fishery of regional importance. This stream reach supports a population of brook trout estimated at 52-1,900 trout per mile (9-169 lbs per mile) (personal communication, March 2000, with Ron Remmick, WGFD, Green River). The remaining streams within the project area are Class 5 waters--low production waters often incapable of sustaining a trout fishery (WGFD 1991). Many of the streams, draws, and washes within the VBPA are ephemeral and are not known to support permanent fish populations.

3.2.3 Wild Horses

The VBPA is within the Salt Wells Creek Wild Horse Herd Management Area (WHHMA) that encompasses 1,193,283 acres from Highway 191 south of Rock Springs east to the Rock Springs-Rawlins District boundary and south to the Wyoming-Colorado state line (BLM 1992, BLM 1996). Approximately 82,778 acres (6.9% of the management area) are within the VBPA (89% of the VBPA). The remainder of the VBPA is within the Pine Mountain Management Area (see Section 3.5.1), an area generally not utilized by wild horses (personal communication, March 2000, with Thor Stephenson, BLM, Rock Springs).

The established appropriate herd management level is between 251 to 365 horses. The estimated herd size is greater than 1,000, with approximately 100 or fewer occupying the VBPA. Range conditions appear to be static in most areas that are inhabited by wild horses populations, and the population of wild horses in the herd unit has remained at or above objectives since the institution of wild horse gathering (personal communication, March 2000, with Thor Stephenson, BLM, Rock Springs).

3.2.4 Threatened, Endangered, Proposed, and Candidate Species (TEP&C)

The *Endangered Species Act* (16 U.S.C. 1531-1543) protects listed threatened and endangered plant and animal species and their critical habitats. To ensure compliance with this act, a BA analyzing the potential effects of the proposed project on threatened, endangered, proposed, and candidate (TEP&C) species has been prepared (BLM 2000). Additional data on TEP&C species and BLM special status species would be collected throughout the LOP during surveys conducted on a case-by-case basis as directed by the BLM. A list of federally listed TEP&C animal and plant species that potentially occur in the vicinity of the proposed project was compiled from several sources, including a letter from the Wyoming State Supervisor Office of the USFWS (USFWS 1999b), The Nature Conservancy's Wyoming Natural Diversity Database (WNDD) (WNDD 2000), and the Colorado Natural Heritage Program (CNHP) (CNHP 2000).

Threatened, endangered, and candidate species are those that have been specifically designated as such by the USFWS. Endangered species are those that are in danger of extinction throughout all or a significant portion of their range. Threatened species are those that are likely to become endangered in the foreseeable future throughout all or a significant portion of their range. Candidate species are those for which the USFWS has sufficient data to list as threatened or endangered, but for which proposed rules have not yet been issued. Special status species are those that may warrant designation as candidate species but sufficient data are not currently available for such a designation decision; these species may be designated as special status species by the BLM.

Threatened and endangered animal species that could occur in the vicinity of the VBPA include black-footed ferret (*Mustela nigripes*), bald eagle (*Haliaeetus leucocephalus*), and whooping crane (*Grus americana*) (Table 3.5). In addition, four species of endangered fish species--bonytail chub (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*)--occur downstream of the VBPA in the Colorado and Green River drainage below Flaming Gorge Dam. Mountain plover (*Charadrius montanus*), a species proposed as threatened also may occur within the VBPA.

Table 3.5 Federal Threatened, Endangered, Proposed, and Candidate Species and Their Potential Occurrence on the Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.[1]

Species		Federal Status[2]	Potential Occurrence on VBPA[3]
Common Name	**Scientific Name**		
MAMMALS			
Black-footed ferret	***Mustela nigripes***	**E**	**X**
Canada lynx	***Lynx canadensis***	**T**	**X**
BIRDS			
Bald eagle[4]	***Haliaeetus leucocephalus***	**T**	**R**
Mountain plover	***Charadrius montanus***	**P**	**U**
Whooping crane	***Grus americana***	**E**	**X**
FISH			
Bonytail chub	***Gila elegans***	**E**	**X**
Colorado pikeminnow	***Ptychocheilus lucius***	**E**	**X**
Humpback chub	***Gila cypha***	**E**	**X**
Razorback sucker	***Xyrauchen texanus***	**E**	**X**
PLANTS			
Blowout penstemon	***Penstemon haydenii***	**E**	**X**
Ute ladies' tresses	***Spiranthes diluvialis***	**T**	**X**

---

[1] Adapted from U.S. Fish and Wildlife Service (USFWS) (1999a).

[2] Federal status (USFWS 1999a):

E = Listed as federally endangered.
T = Listed as federally threatened.
P = Proposed for listing as federally threatened (64 *Federal Register*, 7587-7601 February 16, 1999).

[3] Species occurrence:

U = Uncommon; species may be present in the VBPA, but in such low numbers or in such small and widely scattered populations that an encounter during field development and operation is unlikely. The species could be present for a significant part of the year (e.g., breeding season, summer resident).
R = Rare; species may be in the VBPA for just a few days or hours (e.g., stopping over during migration), or the species has only occasionally or rarely been sighted in the VBPA. Encounters during field development and operation are very unlikely.
X = Unlikely; there has been no recent historical record of the species' occurrence in the VBPA; probability of encountering the species during field development and operation is very unlikely.

[4] Proposed for removal from federal listing.

Canada lynx (*Lynx canadensis*), also a threatened species, has been identified as potentially occurring in the area; however, it is highly unlikely that Canada lynx occurs in the VBPA, since no forested habitat is present. Thus, Canada lynx is not discussed further in this EA.

Two plant species--the threatened Ute ladies' tresses (*Spiranthes diluvialis*) and the endangered blowout penstemon (*Penstemon haydenii*) may also occur within the VBPA.

3.2.4.1 TEP&C Animal Species

Black-footed Ferret. The black-footed ferret, a federally endangered species, was once distributed throughout the high plains of the Rocky Mountain and western Great Plains regions (Forrest et al. 1985). Prairie dogs are the main food of black-footed ferrets (Sheets et al. 1972), and few black-footed ferrets have been historically collected away from prairie dog towns (Forrest et al. 1985). Black-footed ferrets were considered extinct until a small population was discovered near Meeteetse, Wyoming, in 1981. Following outbreaks of distemper, surviving black-footed ferrets were brought into captivity and a captive breeding program was initiated (USFWS 1988). The captive breeding program is designed with the objective of reintroducing the species into suitable habitats in the wild.

USFWS, in cooperation with 11 state wildlife agencies, has identified potential reintroduction sites within the historic range of the species. The sites were chosen based on black-footed ferret habitat requirements and the fact that they were determined to be "ferret free" (i.e., no wild ferret populations present). The Northwestern Colorado/Northeastern Utah Black-footed Ferret Experimental Population Area (ExPA) is one of the sites selected; a portion of the ExPA overlaps the VBPA. The ExPA (approximately 3,015,000 acres) includes portions of Sweetwater County in Wyoming, Moffat and Rio Blanco Counties in Colorado, and Duchesne and Uinta Counties in Utah (BLM 1995). All black-footed ferrets within the ExPA would be designated as part of a nonessential experimental population (i.e., the population is not considered essential to the continued existence of the species).

Two Primary Recovery Areas or sub-management areas are located within the ExPA: the Little Snake Black-footed Ferret Management Area (622,400 acres) that is entirely located within the BLM's Little Snake Field Office in Moffat County, Colorado, which is adjacent to the VBPA; and the Coyote Basin (51,562 acres), located in eastern Utah. These primary recovery areas would be the actual release sites for the ferrets. No black-footed ferrets have been released in Colorado; however, ferrets are in holding pens within the Little Snake Resource Area pending release. Ferrets have been released in the Utah Management Area (personal communication, March 2000, Bob Leachman, USFWS).

The Little Snake Management Area is occupied by approximately 78,000 acres of white-tailed prairie dog colonies (USFWS 1995), and some colonies (2,404 acres) are continuous into Wyoming (personal communication, March 2000, Bob Luce, WGFD); however, the best ferret habitat is within the primary recovery area in Colorado, south of the VBPA. It is most likely that ferrets would concentrate and reproduce in Colorado, and probably would not establish populations in the rest of the experimental population area (BLM 1995).

The Coyote Basin primary recovery area is occupied by approximately 51,562 acres and is noncontinuous into the VBPA. Approximately 10,415 acres of prairie dog town are within this recovery area (personal communication, March 2000, Bob Leachman, USFWS).

The likelihood of the existence of a wild black-footed ferret population is considered almost nonexistent. Numerous surveys conducted from 1981 to 1993 by the USFWS, the Colorado Division of Wildlife, the BLM, and private consultants failed to locate any ferrets, indicating that ferrets have been extirpated in the area (63 *Federal Register*, 52,823-52,841, October 1, 1998). The VBPA has been declared ferret free (personal communication, March 2000, Bob Luce, WGFD).

Bald Eagle. Bald eagle is a federal threatened species (downlisted from endangered and now proposed for removal from federal listing). This species requires cliffs, large trees, or sheltered canyons associated with concentrated food sources (e.g., fisheries or waterfowl concentration areas) for nesting and/or roosting areas (Edwards 1969; Snow 1973; Call 1978; Steenhof 1978; Peterson 1986). Bald eagles forage over wide areas during the non-nesting season (i.e., fall and winter) and scavenge on animal carcasses such as pronghorn, deer, and elk.

No bald eagle nests or winter roosts are known to occur in the VBPA--the lack of suitable nesting or winter roosting habitats within the VBPA precludes its use for such activities by bald eagles. However, Flaming Gorge Reservoir and the Green River, approximately 36 mi west and south of the VBPA, respectively, provide favorable nesting, roosting, and foraging habitat for bald eagles. Thus, although searches of the WNDD and the CNHP revealed no records of bald eagles in the vicinity of the VBPA (WNDD 2000; CNHP 2000), it is likely that individuals occasionally forage in or fly through the area.

Mountain Plover. The mountain plover is proposed for federal listing as threatened. It inhabits the high, dry short-grass plains east of the Rocky Mountains (Dinsmore 1983), as well as the sagebrush grasslands throughout Wyoming (WGFD 1997), and is found in northern Utah and northwestern Colorado (Knopf 1996). The focus of breeding activity appears to be northeastern Colorado (Graul and Webster 1976). Parrish et al. (1993) noted that mountain plover nests in northeastern Wyoming were found in areas of short (<4 inches) vegetation on slopes of less than 3%; any short grass, very short shrub, or cushion plant vegetation type could be considered nesting habitat. Mountain plover breeding/nesting habitat is often associated with prairie dog towns (USFWS 1999a). In Colorado, the mountain plover diet is composed of 99.7% arthropods, with beetles, grasshoppers, crickets, and ants the most important food items (Baldwin 1971). Breeding bird surveys between 1966 and 1987 show an overall decline in the continental population of mountain plovers (U.S. Department of Agriculture, Forest Service [USFS] 1994a). Surveys completed in 1991 indicated that only 4,360 to 5,610 mountain plovers remained on the North American continent (USFS 1994b). Probably the most important reason for the decline of the mountain plover are human impacts and habitat alteration on breeding grounds and degradation in the quality of wintering habitats (e.g., southern Texas, California) (Knopf 1994, 1996). Loss of breeding habitat due to cultivation and prey base declines resulting from pesticide use are also threats to mountain plover survival (Wiens and Dyer 1975). Cattle often maintain the open grass habitat favored by mountain plovers, so livestock grazing may benefit the species (Klipple and Costello 1960).

Approximately 36% of the Vermillion Basin is comprised of a low-growing windblown Gardner's saltbush (*Atriplex gardneri*) plant community. This community is associated with poorly developed thin soils on ridgetops and benches and the upper valley slopes of drainages, and it provides suitable nesting and foraging habitat for mountain plover (written communication, February 9, 2000, with Jim Dunder, BLM). Mountain plover observations have been recorded within 0.5 mi of the VBPA (CNHP 2000) and the species likely forages and nests in the area.

Whooping Crane. A federally endangered species, the whooping crane inhabits moist to wet meadow grasslands, irrigated native and introduced meadows, sedge meadows, and marshes, where it feeds on a variety of plants and animals (WGFD 1992). All WGFD recorded observations of whooping cranes in Wyoming have occurred in the western part of the state; these birds are probably part of the Gray's Lake fostering project (WGFD 1992). Dorn and Dorn (1990) also report several observations of whooping cranes in eastern Wyoming.

Whooping cranes use the Green River as a spring and fall migration corridor; however, no suitable habitat occurs in the VBPA. Neither the WNDD nor the CNHP report historic or recent observations of whooping cranes in the vicinity of the VBPA (WNDD 2000; CNHP 2000), and the likelihood of their presence in the area is extremely low.

Colorado River Endangered Fish Species. The bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker are federally endangered species, and all four species are residents of the Green and Colorado River systems below Flaming Gorge Dam (USFWS 1987; Tyus and Karp 1989; Matthews 1990). Although once abundant throughout both of these river systems, all four species are now limited to reaches of river that are either relatively undisturbed or controlled to provide appropriate flows. Reservoir impoundments and water diversions are the main threats to these species. None of these species occur within or adjacent to the VBPA.

3.2.4.2 TEP&C Plant Species

Blowout Penstemon. Blowout penstemon, a federally endangered species, is a perennial herb associated with blowout depressions in sparsely vegetated active sand dunes. Individual plants have deep root systems and multiple stems which can survive burial in shifting sands. Although early naturalists reported the species as relatively common in the sandhills of western Nebraska, loss of habitat, insect outbreaks, drought, inbreeding, and potential overcollection prompted listing of the species in 1987 (Fertig 1999). Until confirmation of its occurrence in the Ferris Mountains of south-central Wyoming, the species was not known to occur outside of Nebraska. Currently, only 3,000-5,000 plants are known from 12 sites in Nebraska, and 300-500 individuals are documented in the Ferris Mountains.

Ute Ladies' Tresses. Ute ladies' tresses, a federal threatened species, is a perennial member of the orchid family which inhabits moist streambanks, wet meadows, and abandoned stream channels at elevations of 4,500-6,800 ft (Fertig 1994; Spackman et al. 1997). Although the species will tolerate mildly alkaline conditions, it is unlikely to be found in association with Gardner's saltbush, greasewood, or other alkaline vegetation. Where it occurs in ephemeral drainages, ground water is typically shallow (i.e., within approximately 18 inches of the ground surface) (personal communication, March 16, 2000, with Pat Deibert, USFWS; personal communication, March 22, 2000, with Walt Fertig, WNDD).

The species has been documented in Goshen, Converse, and Niobrara Counties in Wyoming (Wyoming Rare Plant Technical Committee 1997) and along the Front Range in northern and central Colorado (Spackman et al. 1997). It also has been reported from below the dam at Flaming Gorge Reservoir approximately 36 mi southwest of the VBPA, and along the Green and Yampa Rivers south of the project area (personal communication, March 22, 2000, with Walt Fertig, WNDD). Although in recent years, much time has been devoted to determining areas in Wyoming where the species occurs, it has not been documented within the VBPA or immediate surroundings (personal communication, March 22, 2000, with Walt Fertig, WNDD).

Black greasewood (*Sarcobatus vermiculatus*) and Great Basin wildrye (*Elymus cinereus*) generally dominate the bottoms of dry washes in the VBPA (personal communication, February 9, 2000, from Jim Dunder, BLM). The presence of greasewood in this plant community indicates that soils in these areas are likely too alkaline to support Ute ladies' tresses, regardless of the depth to ground water.

Riparian communities comprise less than 3% of the vegetative cover in the VBPA. Vermillion, Alkali, and Chicken Creeks and portions of Granery Draw represent the bulk of the riparian areas in the VBPA. Vegetation along these drainages is diverse and includes willow (*Salix* spp.) (primarily on Vermillion Creek), rushes (*Juncus* spp.), Nebraska sedge (*Carex nebrascensis*), and a variety of deep-rooted grasses and forbs (personal communication, February 9, 2000, from Jim Dunder, BLM). Although Ute ladies' tresses has not been documented within the VBPA, these riparian areas represent potential habitat for the species.

3.3 CULTURAL RESOURCES

3.3.1 Cultural Resource Inventories

A Class I inventory was conducted for the VBPA on January 25, 2000 (File Search No. 321). There have been 83 cultural resource inventories conducted within the VBPA. The majority are Class III intensive linear surveys, several Class III small block inventories, and one large Class II block sampling survey. The surveys ranged in size from 2 to 480 acres, and were conducted because of seismic lines, pipelines, well pads, access roads, and other miscellaneous projects. These surveys were conducted between 1975 and 1998 and included 4,886 acres, or 5% of the VBPA.

Two projects in particular account for the majority of cultural resource inventories in this area. The largest project to date was completed in 1996 by JBR Environmental Consultants for Marathon Oil Company's Vermillion Basin 3-D Seismic project. This Class III linear survey passed through portions of approximately 107 of the 155 sections within the VBPA. Another cultural resource project conducted in 1981 accounts for the majority of block acreage surveyed. Metcalf-Zier Consultants conducted a Class II sampling survey of 3,520 acres in the Green River-Washakie Class II project area for the BLM.

Existing information from the 83 cultural resource projects within the VBPA indicates that 391 cultural resource sites have been recorded in the area to date, consisting of 286 prehistoric sites, 96 historic sites, three sites with both prehistoric and historic components, and six sites of unknown classification (Class I file search results). Fifty-five prehistoric sites and 27 historic sites have been recommended as eligible for the National Register of Historic Places (NRHP), and 34 prehistoric sites and 18 historic sites remain unevaluated as to their NRHP status.

3.3.2 Prehistoric Site Types and Distributions

Three types of prehistoric sites occur within the VBPA. One hundred ninety (66%) were lithic scatters and/or knapping stations. There were 94 (33%) open camps/habitation sites with hearths and/or fire-cracked rock among the features and artifacts (some with ceramics), and two (1%) of the sites consisted of cairns. In addition, there are the remains of a brush corral or drive line east of the project area that may have been used to trap antelope or bighorn sheep during the Late Prehistoric or early Historic periods (Russ Tanner, BLM Archaeologist, personal communication, February 9, 2000).

For a current, detailed discussion of site distribution and site densities among the different geographic subregions within and adjacent to the VBPA, as well as the associated prehistoric cultural chronology of the region, see *Cultural Resource Overview of the Continental Divide/Wamsutter II Environmental Impact Statement Project Area* (TRC Mariah Associates Inc. 1998).

3.3.3 Native American Sensitive Sites and Traditional Cultural Properties

The VBPA was used from the Protohistoric period through the mid-nineteenth century predominantly by members of the Shoshone and/or Eastern Shoshone tribes on their seasonal rounds of subsistence, although the Bannock, Ute, and other tribes frequented the Washakie Basin and surrounding environs as well. In prehistoric times this picture is clouded because tribal distinctions are difficult, if not impossible, to determine. Both prehistoric sites and more modern Native American use sites are sensitive, or can be considered Traditional Cultural Properties (TCPs). Sites and properties within this designation are protected by numerous laws, including the *Native American Graves Protection and Repatriation Act*, the *American Indian Religious Freedom Act*, and various Executive Orders. Human burials, rock alignment sites, petroglyphs, steatite procurement locales, and modern-day Native American use, extraction, or religious sites are considered sensitive or sacred to modern Native Americans. No sites within the VBPA have been positively identified as TCPs with the possible exception of two known prehistoric cairns (Sites 48SW11306 and 48SW3058).

3.3.4 Historic Site Types and Distributions

There are a variety of historic sites within the VBPA. The region was sparsely utilized by early settlers, primarily as grazing lands for sheep and cattle during the early twentieth century, followed by oil and gas development during the latter half of the century. Of the 96 historic sites scattered within the VBPA, the majority (44) are linear transportation sites that are segments of the well-known Cherokee Trail (Site 48SW3680), the lesser known Rock Springs to Browns Park Road (Site 48SW3865), and the (NRHP-ineligible) Rock Springs to Hiawatha Road (Site 48SW10752). In addition, there are historic sites that are more archaeological in character, including 29 artifact/debris scatters, 13 campsites and homesteads (including two cabins--Site 48SW4609), nine rock cairns, one gas field (Site 48SW3871), and one site with more than one grave (Site 48SW3887). Ancillary historic sites which may occur in the area include shearing pens, lambing pens, corrals, windmills, ditches, and stock ponds.

Perhaps the most significant historic site in the VBPA is the NRHP-eligible 1850 route of the Cherokee Trail. The BLM and SHPO have established that the Cherokee Trail is eligible for the NRHP. Some traces of the trail are known, but the exact route across the VBPA has not been determined, evaluated, or marked. This trail variant was blazed by a party of Euro-Americans and members of the Cherokee Indian Nation across the extreme southern portion of Wyoming, dipping into northern Colorado several times on their way to Fort Bridger along the Oregon Trail on their way to the California gold fields. A similar party of whites and Cherokee Indians took a more northerly course to California during the initial 1849 rush, which approximated, but was not the same as, the 1862 Overland Stage route (Fletcher et al. 1999). Because Cherokee Indians accompanied both the 1849 and

1850 parties that crossed southern Wyoming, there has been considerable confusion as to the route of the Cherokee Trail in the historic literature (Fletcher et al. 1999). It is unlikely that the Cherokee Trail was ever used again as a primary migratory emigrant route across Wyoming. The Overland Trail replaced the trail as the main thoroughfare from 1862 until 1869, when the transcontinental railroad was completed. The Overland Trail continued to be used to a limited degree into the early twentieth century.

Four segments of the 1850 trail variant have been identified as passing through the south-central portion of the VBPA. These segments were identified during the 1996 Class III linear inventory conducted for the Vermillion Basin (Marathon) 3-D Seismic Project, and recently verified from aerial reconnaissance by BLM archaeologist Russ Tanner.

The NRHP-eligible Rock Springs to Browns Park Road passes through the southeast portion of the VBPA. Located south of the project area, Browns Park is well known for its association with outlaws such as Butch Cassidy and other infamous characters of popular late-nineteenth century western history. There are extant cabins attributed to Cassidy and others, as well as inscriptions on rock outcrops near the cabins in Browns Park near the Southfork of Powder Springs. The exact route of the Rock Springs to Browns Park Road has not been marked or evaluated for NRHP eligibility.

3.4 SOCIOECONOMICS/ENVIRONMENTAL JUSTICE

Wyoming's population increased from 332,416 in 1970 to 469,557 in 1980--a 41% increase--as people moved into the state seeking employment in mining, petroleum, and related industries. Falling mineral prices in the early 1980s slowed the influx of job seekers and resulted in significant unemployment. By 1990, Wyoming's population had fallen 3.4% from 1980 levels, to 453,588 (U.S. Department of Commerce [USDOC] 1990). Wyoming's estimated population in 1998 was 480,907--a 6% increase over 1990--and is projected to rise to 504,350 by 2008 (Wyoming Division of Economic Analysis [WDEA] 2000). Sweetwater

County's population increased by 127% during the 1970-1981 energy boom, exhibiting an even more dramatic growth pattern than Wyoming as a whole. However, the subsequent slump in energy production between 1981 and 1987 contributed substantially to increasing unemployment throughout the state, and by 1990 Sweetwater County's population had dropped to 38,823–down 13.7% from a peak population of 45,008 in 1981 (Wyoming Department of Administration and Information [WDAI] 1991). The two largest cities in the county are Rock Springs (1997 estimated population of 19,522) and Green River (1997 estimated population of 13,086). Both are long-established population centers with facilities generally adequate to support their respective populations.

Despite the net loss of population during the 1980s, Sweetwater County has maintained a relatively stable population due to oil and gas exploration, the increased demand for soda ash (trona), coal mines in the east-central portion of the county, and the Bridger Power Plant. The Sweetwater County population rose 2.5% from 1990 to 1998, to 39,780, and is anticipated to remain rather stable through 2008 (WDEA 2000), although some previous estimates had anticipated the 2000 population to reach 47,700 (Woods & Poole Economics, Inc. 1993).

Trona mining and oil and gas exploration and development have been key factors in Sweetwater County's economic stability. In 1998, 15,668 (80%) of the 19,502 average annual employees in Sweetwater County were employed by private industry, with the remaining 20% were employed by state, local, or federal government (Wyoming Department of Employment [WDOE] 2000a). The mining sector of the economy, which includes oil and gas exploration and development, provided 3,813 jobs–the most of any employment sector–which accounted for 24% of all private employment and 20% of total employment in Sweetwater County. The mining sector also provided the largest payroll–33% of the total annual payroll in the county–and the second highest average weekly and annual wages–$1,068 and $55,512, respectively. Mining sector wages were approximately 170% of the average wage in the county.

Sweetwater County had an assessed valuation of $988.1 million in 1996 (Wyoming Department of Revenue [WDR] 1997). The assessed valuation of Rock Springs was $63.5 million (Wyoming Taxpayers Association 1996). Taxes on the mineral industry are the primary source of tax revenues for the county, and the natural gas industry provided 39.7% of this base (University of Wyoming [UW] 1996). The 1996 assessed valuation of natural gas production in Sweetwater County was $185.7 million, and in 1995, gas production provided the county and cities/towns with $55,000 and $937,000, respectively, in returned federal mineral royalties. Additionally, public schools and local governments in Sweetwater County received $13.1 million and $7.7 million, respectively, in state natural gas production tax revenues.

Sales and use taxes collected in Sweetwater County in fiscal year 1996 totalled $35.6 million, with the county general fund receiving $2.6 million and Rock Springs receiving $7.9 million (WDR 1996). Property taxes collected in Sweetwater County in 1996 totalled $70.7 million (WDR 1997), and in 1996, Sweetwater County and Rock Springs received $355,000 and $645,000, respectively, in severance tax revenues (personal communication, September 1996 and June 1997, Wyoming State Treasurer's Office, Cheyenne, Wyoming).

Executive Order 12898 directs the BLM to assess whether the Proposed Action or alternatives would have disproportionately high and adverse human health or environmental impacts on minority and low-income populations. Identification of environmental issues is accomplished through public involvement and the scoping process. Native American tribes potentially affected by the project have been contacted by the BLM and invited to comment on the Proposed Action and alternatives. The BLM has determined that issues associated with environmental justice would not be affected by the project; therefore, they are not discussed further in this EA. Coordination with Native American tribes will continue, especially regarding cultural resources.

3.5 LANDOWNERSHIP AND USE

Surface landownership within the 92,490-acre VBPA is approximately 85,610 acres (92.6%) of federal surface and minerals; 4,840 acres (5.2%) of State of Wyoming surface and minerals; 640 acres (0.7%) of federal surface and State of Wyoming minerals; 640 acres (0.7%) of State of Wyoming surface and federal minerals; and 760 acres (0.8%) of private surface and minerals (Map 3.7).

The VBPA is within BLM's RSFO, and the major land uses within the area are livestock grazing, wildlife and wild horse habitat, oil and gas exploration and development, and dispersed outdoor recreation (e.g., hunting, hiking, camping, wild horse and wildlife observation, nature photography, and ORV use. There are numerous prior use authorizations for the public lands within the VBPA including natural gas and oil development, transportation, power, and communications ROWs. Development within the VBPA currently occupies approximately 1,105 acres and is primarily related to oil and gas exploration and production (see Table 2.1).

3.5.1 Pine Mountain Management Area

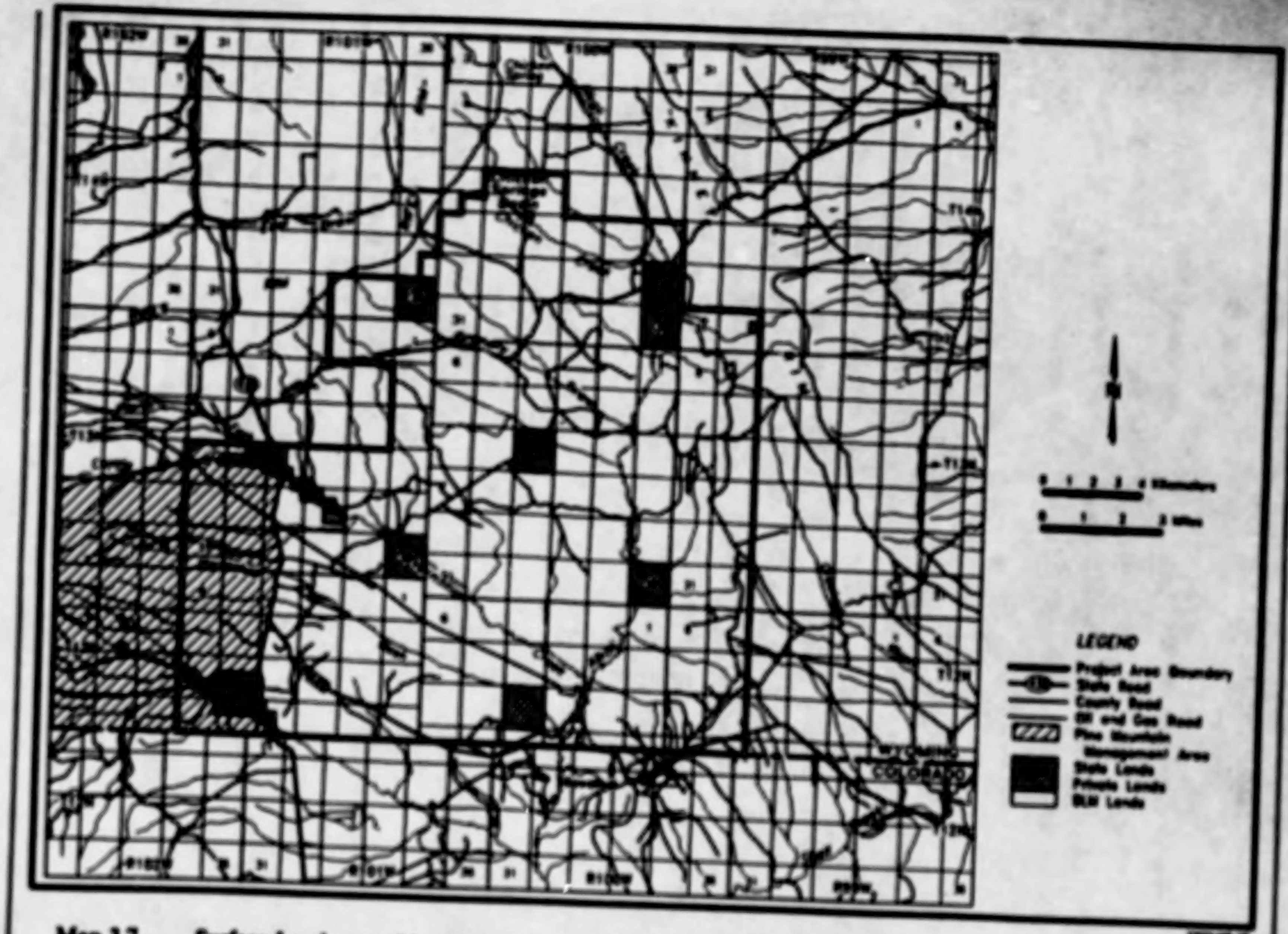
A portion (9,712 acres) of the 64,200-acre Pine Mountain Management Area (PMMA) occurs in the western portion of the VBPA (see Map 3.7). The area is not designated as an ACEC, but will be maintained as a geographic management unit--an area where activities are managed to ensure that a combination of resource values are adequately maintained (BLM 1996).

The management objectives for the area are:

- to improve watershed condition and enhance watershed values and to improve riparian areas to PFC, as a minimum;
- to provide opportunities for dispersed recreation uses in the area consistent with primary watershed, riparian, and wildlife objectives;

BLANK

PAGE



Map 3.7 Surface Landownership, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

132

- to maintain and protect important wildlife habitat, especially raptor habitat; and
- to reduce erosion.

The area is open to mineral leasing and related exploration and development activities with appropriate mitigation requirements (controlled surface use) applied to protect all resource values. The area is also open to consideration of such activities as fencing, interpretative signs, transportation or other uses barriers, and sediment or erosion control structures to meet resource management objectives (BLM 1996).

Any actions to be conducted in the PMMA would be considered and analyzed on a case-by-case basis. Controls may be placed on the amount, sequence, timing, or level of activity or development that may occur to assure that the actions would be consistent with or help meet the management objectives for the area. This may result in such things as limiting the number of roads and other construction or other surface-disturbing activities (such as well pads) or deferring activities or development in some areas until areas have been reclaimed and restored to previous uses.

Livestock grazing objectives will be re-evaluated and, as needed, modified to be consistent with the watershed, water quality, fisheries, recreation, and riparian management objectives. Grazing systems will be designed to achieve desired plant communities and PFC of watersheds (upland and riparian). Restrictions for protection of raptors, big game crucial winter range, and big game calving/fawning areas will apply. ORV travel is limited to designated roads.

3.5.2 Livestock Grazing

Livestock grazing is the major form of agricultural activity within the VBPA due to limited water, aridity, and poor soil. The VBPA includes portions of five grazing allotments--

Vermillion Creek, Alkali Creek, Crooked Creek, Horseshoe Wash, and Pine Mountain (Table 3.6, Map 3.8). The Vermillion Creek allotment occupies 149,193 acres and provides 12,118 animal unit months (AUMs) (an AUM is the amount of forage required to maintain a 1,000 pound cow and calf under 6 months of age, five sheep, or one horse for 1 month) (BLM, unpublished data, n.d.) for an average of 12.3 acres per AUM. The portion of the allotment within the VBPA (51,887 acres) provides approximately 4,218 AUMs. The allotment is grazed by cattle and sheep in winter and range condition trend is static (personal communication, April 2000, with Thor Stephenson, BLM, Rock Springs).

The Alkali Creek allotment occupies 29,226 acres and provides 2,283 AUMs for an average of 12.8 acres per AUM. The portion of the allotment within the VBPA (15,446 acres) provides approximately 1,207 AUMs. This allotment is grazed by primarily by sheep and secondarily by cattle in spring and fall and range condition trend is considered static.

The Crooked Wash allotment occupies 11,143 acres and provides 2,292 AUMs for an average of 4.9 acres per AUM. The portion of the allotment within the VBPA (8,417 acres) provides approximately 1,718 AUMs. This allotment is grazed by sheep in winter and range condition trend is considered static.

The Horseshoe Wash allotment occupies 7,663 acres and provides 607 AUMs for an average of 12.6 acres per AUM. The portion of the allotment within the VBPA (7,029 acres) provides approximately 558 AUMs. This allotment is grazed by sheep in winter and range condition trend is considered static.

The Pine Mountain allotment occupies 70,632 acres and provides 7,763 AUMs for an average of 9.1 acres per AUM. The portion of the allotment within the VBPA (9,712 acres) provides approximately 1,067 AUMs. This allotment is grazed primarily by cattle, though some sheep are also grazed in spring, summer, and fall (June through October) and range condition is in an upward trend.

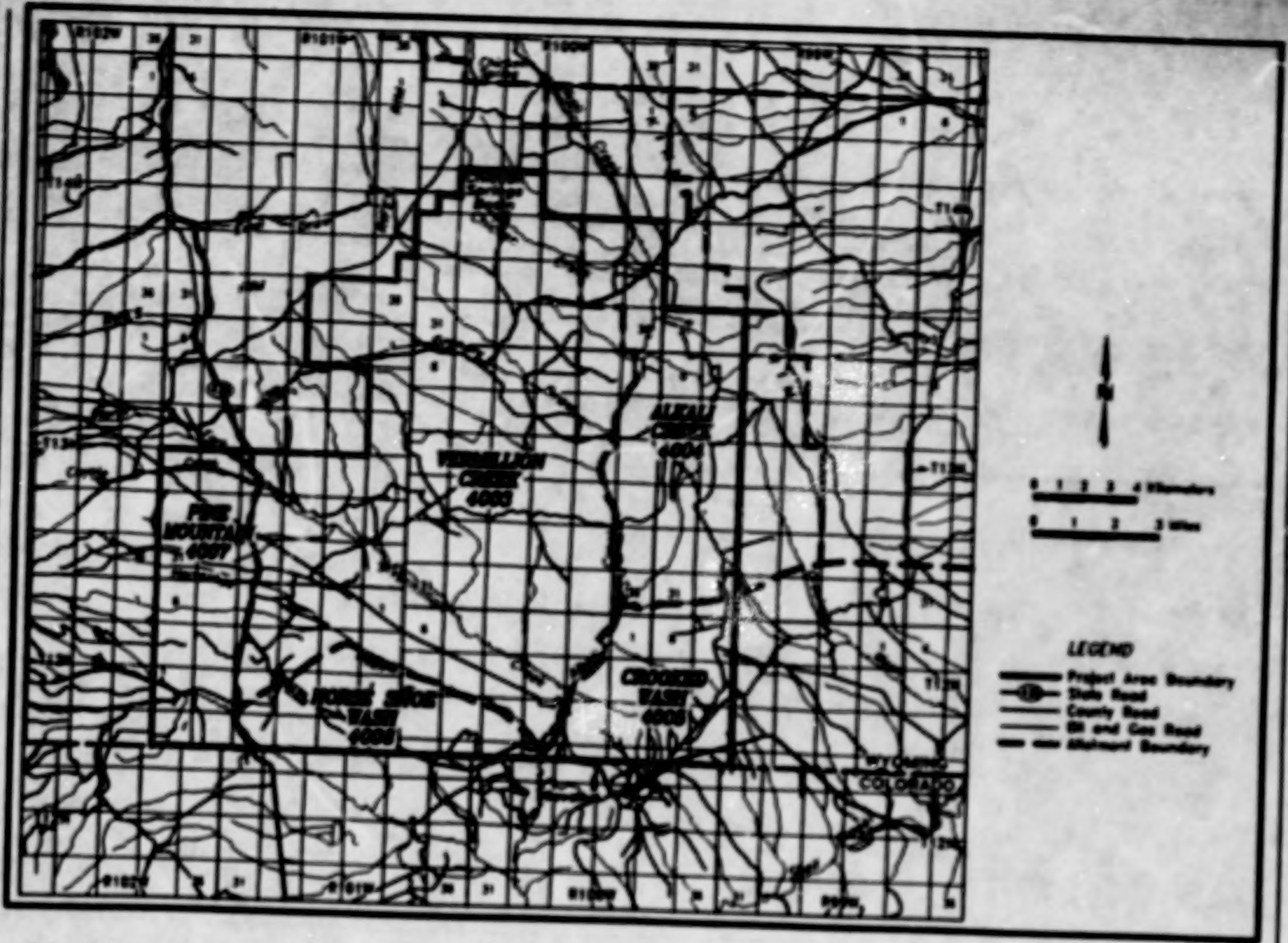
Table 3.6 Grazing Allotment Acreage, Animal Unit Month (AUM) and Category, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000 (BLM 2000 Unpublished Data).

Allotment	Total Acres in Allotment	Total AUMs Available	Acres/ AUM	Approximate Acres in VBPA	Percent of Project Area	Approximate AUMs in VBPA	Livestock Type[1]	Category[2]	Season of Use	Trend
Vermillion Creek (04003)	149,193	12,118	12.3	51,886	56.1	4,218	Cattle/Sheep	I	Winter	Static
Alkali Creek (04004)	29,226	2,283	12.8	15,446	16.7	1,207	Sheep/Cattle	M	Spring, Fall	Static
Crooked Wash (04005)	11,143	2,292	4.9	8,417	9.1	1,718	Sheep	I	Winter	Static
Horseshoe Wash (04006)	7,663	607	12.6	7,029	7.6	558	Sheep	I	Winter	Static
Pine Mountain (04007)	70,632	7,763	9.1	9,712	10.5	1,067	Cattle/Sheep	I	Spring, Summer, Fall	Upward
Total	267,857	25,063				8,768	–	–	–	–

[1] "Bold" indicates the dominant livestock use.

[2] Category (based on GRRA RMP [BLM 1996]); trend based on personal communication, April 2000, Thor Stephenson, BLM, Rock Springs.

I = Improve Category:	Present range condition is unsatisfactory or in a declining trend. Present management is considered satisfactory. Allotments have moderate to high resource production potential but are producing at low to moderate levels. Riparian areas are presently in a declining trend and management is unsatisfactory. Serious resource conflicts may exist and controversy is at a high level. Potential for high return on public investment exists.
M = Maintenance Category:	Present range condition is satisfactory. Present management is considered satisfactory. Allotments have moderate or high resource production potential and are producing near their potential (or trend is moving that direction). Riparian areas are under satisfactory management and are not in a declining trend. No serious conflicts exist with regard to current uses of resource. Potential may exist for positive economic returns on public investments.



Map 3.8 Grazing Allotments, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

136

3.5.3 Transportation

Surface transportation in the VBPA is provided by a network of 138 mi of primary, secondary, local, and primitive roads. Access to the VBPA is provided by WY-430, Sweetwater County Roads 4-19 and 4-25, existing oil/gas field roads, and other roads that are used for recreation, grazing management, and mineral exploration and development (see Map 2.1). I-80, north of the project area, is the principal roadway linking Sweetwater County with the rest of southern Wyoming and the national highway system.

3.5.4 Recreation

Recreation in the VBPA is dispersed outdoor recreation such as hunting, hiking, camping, wild horse and wildlife observation, nature photography, and ORV use. One hundred fifty-three hunters spent 409 days and harvested 129 pronghorn from the South Rock Springs herd in 1998. The VBPA includes approximately 2% of this herd unit. Six hundred twenty-nine hunters spent 1,666 days and harvested 546 pronghorn from the Bitter Creek herd in 1998. The VBPA includes approximately 4.4% of this herd unit. Three hundred forty-two hunters spent 1,697 days and harvested 248 mule deer from the South Rock Springs herd in 1998. The VBPA includes approximately 6.2% of this herd unit. In small game, upland game, and furbearer management area number 6, which includes the VBPA, 452 hunters spent 955 days to harvest 1,165 sage grouse; 70 hunters spent 146 days to harvest 299 mourning doves; 783 hunters spent 3,030 days to harvest 5,571 cottontail rabbits; and 25 hunters spent 31 days to harvest 50 snowshoe hares (WGFD 1999).

3.6 AESTHETICS AND VISUAL RESOURCES

The VBPA landscape can be viewed from WY-430, the major thoroughfare bisecting the western portion of the area from north to south, and from two Sweetwater County roads and various unimproved roads (see Map 2.1). The landscape is primarily open undisturbed rangelands vegetated by sagebrush, grasses, saltbush, and greasewood, with occasional cottonwoods and willows along drainages (see Section 3.2.1). Topography is often broken by ephemeral drainages and rock outcrops. Major geological features include Kinney Rim, Scrivner Butte, and Rifes Rim. Developments within the VBPA occupy approximately 1,105 acres (see Table 2.1) and include approximately 154 active and/or unreclaimed gas wells, 163 mi of improved and unimproved roads, 23 acres of ancillary facility disturbances and 222 acres of other developments. These developments are obvious in the existing landscape character and contribute to visual resource characteristics on much of the VBPA.

The BLM has developed the VRM system to specify objectives for maintaining or enhancing visual resources, including the amount of acceptable change to the existing landscape necessary to meet established goals. The VRM system uses five classes to define visual resource values, ranging from Class I, the most restrictive (e.g., wilderness areas), to rehabilitation areas (formerly Class V), where, among other things, the natural character of the landscape has been disturbed to the point where rehabilitation is needed to bring it up to one of the other four classifications. The most visually sensitive lands in the vicinity of the VBPA are those of the 64,200-acre PMMA which are designated as Class III. Approximately 9,712 acres of the PMMA are located within the project area (see Map 3.7). These lands are managed to partially retain the existing character of the landscape (see Section 3.5). The remainder of the VBPA is designated Class IV--areas where changes in the basic elements may subordinate the original composition and character of the landscape, but should reflect what could be a natural occurrence in the characteristic landscape.

3.7 HAZARDOUS MATERIALS

Hazardous substances present in the VBPA include those used and produced in association with natural gas exploration, development, and production, and are identified in Section 2.1.12 (BLM 1998a).

4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION

The potential environmental consequences of construction, drilling, completing, operation, and maintenance associated with the Proposed Action and No Action Alternative are discussed for each potentially affected resource. An environmental impact is defined as a change in the quality or quantity of a given resource due to a modification in the existing environment resulting from project-related activities. Impacts can be beneficial or adverse, can be a primary result (direct) or a secondary result (indirect) of an action, and can be permanent or long-lasting (long-term--more than 5 years) or temporary and of short duration (short-term--5 years or less). Impacts can vary in degree from a slightly discernable change to a total change in the environment.

In accordance with CEQ regulation 40 C.F.R. 1502.16, this chapter includes a discussion of the direct and indirect effects of the Proposed Action and No Action Alternatives and their significance. Possible conflicts between the Proposed Action and alternatives and the objectives of the BLM's RMPs as well as state and local land use plans and policies are identified, as are means to mitigate adverse environmental impacts not adequately mitigated by applicant-committed measures. Potential impacts for this project were quantified where possible. The use of adjectives such as moderate, low, and negligible have been avoided wherever possible because this EA is an analytical document, not a decision document (BLM 1996b). The Decision Record for this project will be the decision document. However, when impacts are not easily quantifiable, appropriate adjectives to describe the severity of potential impacts have been used. Impact assessment assumes that applicant-committed measures are successfully implemented. If such measures are not implemented (e.g., state and private lands), additional adverse impacts may occur.

Each resource discussed in this chapter includes a description of the following:

- management objectives, as defined in the GRRA RMP (BLM 1992, 1996) and ROD (BLM 1997a), the WSLUP (Wyoming State Land Use Commission [WSLUC] 1979), the SCBC (1996), and the Standards for Healthy Rangelands (BLM 1997b);
- the level and duration of direct and indirect impacts that would occur as a result of the Proposed Action and the No Action Alternative assuming that applicant-committed practices as described in Chapter 2.0 would be implemented;
- mitigation measures, in addition to those described in Chapter 2.0, that could be applied to avoid or further reduce adverse impacts;
- cumulative impacts that would result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions; and
- unavoidable adverse impacts that cannot be avoided nor completely mitigated.

Reasonably foreseeable development is that development likely to occur within the project area or the cumulative impacts assessment area (CIAA) within the next 5 years. In the case of the VBPA, there is no reasonably foreseeable development other than the Proposed Action. Other natural gas fields, such as the Continental Divide/Wamsutter II, Table Rock/Patrick Draw, Mulligan Draw, Dripping Rock, Creston/Blue Gap, and South Baggs projects, are distant enough from the VBPA that, in most cases, it is not logical to include them in an evaluation of cumulative environmental impacts from the VBPA. Exceptions to this, such as air quality and wildlife, are noted in the appropriate sections of this EA. CIAAs are identified in Table 4.1. Other existing or proposed projects (i.e., Brady Unit, Desolation Flats) may be excluded due to the absence of foreseeable development (Brady Unit) or a lack of sufficient information for this analysis (Desolation Flats).

Table 4.1 Cumulative Impact Assessment Areas, Vermillion Basin Project Area, Sweetwater County, Wyoming.

Resource	Cumulative Impact Assessment Area
Air Quality	Project-affected locations within southern Wyoming and northern Colorado (see Map 3.1)
Topography/Physiography	VBPA
Geology (general)	
Mineral Resources	VBPA
Geologic Hazards	VBPA
Paleontological Resources	VBPA
Soils	Vermillion Creek Watershed
Water Resources	
Surface Water	Vermillion Creek Watershed
Ground Water	Project-affected aquifers within the VBPA
Noise and Odor	VBPA and 1-mi buffer
Vegetation	
General	VBPA
Wetlands/Riparian Areas	Project-affected watersheds within VBPA
Wildlife and Fisheries	
Big Game	Herd units
Other Mammals	VBPA and 2-mi buffer
Sage Grouse	Upland Game Bird Management Area 6
Raptors	VBPA and 1-mi buffer
Fisheries	Vermillion Creek Watershed
Other Species	VBPA
Wild Horses	Project-affected wild horse herd management areas (WHHMAs) within VBPA
Threatened, Endangered, Proposed, Candidate, and Other Sensitive Animal and Plant Species	Range of various species
Cultural Resources	VBPA and 1-mi buffer
Socioeconomics/Environmental Justice	Sweetwater County
Landownership and Use	VBPA
Aesthetics and Visual Resources	VBPA

Irreversible and irretrievable commitments are discussed in Section 4.8 and include permanent reductions or losses of resources that, once lost, cannot be regained. Short-term use of the environment versus long-term productivity is discussed in Section 4.9, and discusses the relationship between the use of the environment during the LOP as compared to long-term productivity after the project is abandoned and disturbed areas are reclaimed.

4.1 PHYSICAL RESOURCES

4.1.1 Air Quality

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a), Standards for Healthy Rangelands (BLM 1997b), state (WSLUC 1979) and local (SCBC 1996) land use plans address the following management objectives associated with air quality:

- comply with all federal and state air quality laws, rules, regulations, and standards;
- maintain and, where possible, enhance air quality; and
- within the scope of BLM's authority, minimize emissions which may add to atmospheric deposition (acid rain) or reduce visibility.

Failure to comply with these management objectives could result in significant impacts.

4.1.1.1 The Proposed Action

Pollutants of concern for this project are those regulated by the WDEQ/AQD and the EPA, including NO_x, SO_2, CO, VOCs (including HAPs), total suspended particulates (TSP) and particulates less than 10 microns in diameter (PM_{10}). The Operators would institute practices to ensure that emissions would be minimized (see Section 2.1.13.2). These would include following all regulations promulgated by WDEQ/AQD; limiting new field emissions of NO_x so as not to exceed 200 tpy; keeping internal combustion engines in good working order; enforcing speed limits and, if necessary, applying water or other substances to roads to reduce the generation of fugitive dust; and prohibiting the burning of garbage or refuse at well locations.

The effects of natural gas development on air quality in southwestern Wyoming have been studied extensively in recent years, including the Jonah Field II air quality study (BLM 1998c:Appendix G) that modeled the impacts of 450 wells; the Continental Divide/Wamsutter II air quality study (BLM 1999d, 1999e) that modeled the impacts of 3,000 wells; and the Pinedale Anticline air quality study (BLM 1999c) that modeled the impacts of 700 wells. Only the Jonah Field II study found significant cumulative far-field effects to visibility; however, the Jonah Field II study used a screening methodology to estimate far-field effects whereas the Pinedale Anticline and the Continental Divide/ Wamsutter II studies used a more refined approach (i.e., CalPuff dispersion modeling system) and found no significant impacts to visibility at nearby wilderness areas.

There would be some temporary deterioration to air quality in the immediate vicinity of activities such as construction, development, and production of natural gas due to particulate matter and exhausts from equipment and vehicles; however, these would be localized, temporary, and quickly dispersed by the wind. There is no reason to believe the Proposed Action would result in significant impacts to air quality in the Vermillion Basin.

Total estimated near field emissions from the project are anticipated to be less than (approximately 2% of) those of the Continental Divide/Wamsutter II Project (BLM 1999d, 1999e):

- 124 $\mu g/m^3$ (24-hr TSP);
- 35 $\mu g/m^3$ (24-hr PM_{10});
- 20 $\mu g/m^3$ (annual PM_{10});
- 52 $\mu g/m^3$ (3-hr SO_2);
- 22 $\mu g/m^3$ (24-hr SO_2);
- 6 $\mu g/m^3$ (annual SO_2); and
- 31 $\mu g/m^3$ (annual NO_2).

4.1.1.2 The No Action Alternative

Under the No Action Alternative there would be no additional development in the VBPA and impacts to air quality would remain at existing levels in the foreseeable future.

4.1.1.3 Mitigation

The WDEQ/AQD may require additional air quality analysis as part of the permitting process for additional compression and/or well location development, and the BLM may require copies of the results of these analyses as part of the APD or ROW process. Furthermore, the BLM may require Operators to conduct emissions checks on all internal combustion engines.

4.1.1.4 Cumulative Impacts

The Jonah Field II air quality study (BLM 1998c:Appendix G) demonstrated that both short- and long-term total predicted TSP, PM_{10}, SO_2, CO, VOC, HAPs, and NO_x concentration would comply with applicable air quality standards (i.e., WAAQS and NAAQS) as a result of direct, indirect, and cumulative project emissions (including construction and operation). Analyses presented in the Pinedale Anticline air quality studies (BLM 1999c) also found no significant impacts to near-field air quality standards at a well density of 16 wells location per 640-acre section) (see Section 4.1.1.1). Therefore, there is no reason to believe that the Proposed Action would result in significant adverse impacts to air quality in the Vermillion Basin or elsewhere.

4.1.1.5 Unavoidable Adverse Impacts

There would be some temporary deterioration to air quality in the vicinity of activity relating to construction, development, and production of natural gas due to particulate matter and exhausts from equipment and vehicles; however, these would be localized and temporary, and would be quickly dispersed by the wind.

4.1.2 Topography and Physiography

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a), state (WSLUC 1979) and local (SCBC 1996) land use plans address the following management objectives associated with topography and physiography:

- maintain and protect the beauty of natural vistas;
- coordinate land use decisions with economic factors;
- maintain or improve the quality of air, water, and land resources;
- review all land exchanges;
- provide for the disposition of solid waste to protect the environment from degradation and scenic resources from unsightly litter; and
- establish a balance between resource conservation and economic development.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.1.2.1 Proposed Action

The maximum new disturbance resulting from the Proposed Action would be 505 acres initially and 165 acres for the LOP (0.5% and 0.2% of the VBPA, respectively) (see Table 2.1). Surface disturbance would occur within the Vermillion Creek watershed. Proposed development activities would not require moving large amounts of earth, and no prominent landforms (e.g., Kinney Rim, Rife Rim, or Scrivner Butte) would be destroyed. Prominent landforms would be avoided, where possible, and disturbance within the PMMA would be restricted or avoided. Roads would be constructed in adherence to BLM transportation planning guidelines and would follow specifications presented in Section 9113, road standards manual (BLM 1985, 1991a), which requires restoration of surface drainage patterns with culverts, ditches, or other means during construction. Pipelines would be constructed using standard industry practices, which include provisions for drainage crossing and restoration.

Impacts to topography and physiography resulting from the Proposed Action would not be significant for the LOP and beyond because all disturbed areas would be reclaimed. The only permanent impacts would be associated with roads designated by the BLM to remain unreclaimed after the project is completed. The primary impacts to topography and physiography would be changes to the landscape from cut-and-fill activities during well pad and road construction.

4.1.2.2 No Action

No additional impacts to topography and physiography are anticipated under the No Action Alternative. However, impacts to topography and physiography under this alternative, should they occur, could be increased from those of the Proposed Action due to the absence of coordinated reclamation and transportation planning efforts. Total long-term disturbance within the VBPA would continue at the existing 1,105 acres (1.2% of the area) (see Table 2.1). This disturbance includes the continued operation of the 82 producing wells, 137.2 mi of associated roads, existing pipelines, and 23 acres of existing ancillary facilities. In the absence of further development in the area, no impacts to topography and physiography would occur, and existing VBPA topographic and physiographic features would remain unchanged.

4.1.2.3 Mitigation

The BLM may require that disturbance from gravel pits be limited to 5.0 acres at any one time.

4.1.2.4 Cumulative Impacts

The CIAA for topography/physiography is the VBPA. Maximum total existing (1,105 acres), proposed (long-term, 165 acres), and reasonably foreseeable surface disturbance includes approximately 1,270 acres (1.5% of the VBPA). Past, present, and reasonably foreseeable actions generally require restoration of disturbed areas to predisturbance conditions. Some topographic alterations, such as disturbances from wellpads, may remain for several years. Others, such as the cuts and fills associated with existing major roads and highways, would be permanent. However, these changes generally affect a very small portion of the total land surface, and the relatively flat terrain in the area would make such changes insignificant in both the short-term and long-term.

Although there is widespread oil and gas development in southwestern Wyoming, standard stipulations and project- and site-specific construction and reclamation procedures are normally required to be implemented to maintain surface drainage patterns and implement reclamation procedures that include regrading and recontouring disturbed areas to approximate original conditions, re-establishing appropriate vegetative cover, and stabilizing reclaimed landscapes

4.1.2.5 Unavoidable Adverse Impacts

Some minor LOP changes in topography would occur due to cut-and-fill during well pad and road construction.

4.1.3 Geology and Geologic Hazards

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a) and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with geologic hazards:

- protect the health and safety of the public and the well-being of sensitive natural resources;
- minimize the loss of life and property from natural hazards; and
- generate and provide data on development limitations.

Failure to comply with one or more these management objectives could result in significant impacts.

4.1.3.1 The Proposed Action

The depth of gas reserves in the VBPA negate the potential for subsidence; however, there is potential for some localized subsidence associated with the abandoned coal mines. All project-related facilities would be designed and constructed to withstand the effects of moderate earthquakes; therefore, no impacts from earthquakes are anticipated. There are known landslide areas within the VBPA; however, these are primarily located within the PMMA, where surface disturbance restrictions are in force. Therefore, the Proposed Action is not likely to affect or be affected by landslides.

4.1.3.2 No Action Alternative

Under the No Action Alternative there would be no additional impacts related to geological hazards. However, impacts to or from geologic hazards under this alternative could be increased from those related to the Proposed Action because of the absence of coordinated reclamation and transportation planning efforts.

4.1.3.3 Mitigation

No additional mitigation is recommended.

4.1.3.4 Cumulative Impacts

The CIAA for geologic hazards is the VBPA; therefore, cumulative impacts would be the same as described for the Proposed Action.

4.1.3.5 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts related to geological hazards.

4.1.4 Paleontological Resources

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a) and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with paleontological resources:

- expand the opportunities for scientific study and educational and interpretive uses of paleontological resources;
- protect and preserve important paleontological resources and their historic record for future generations; and
- resolve conflicts between paleontological resources and other resource uses.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.1.4.1 The Proposed Action

Direct impacts to fossils could include damage or destruction of important fossils during construction, with subsequent loss of scientific information. Adverse indirect impacts could include fossil damage from accelerated erosion due to surface disturbance.

Beneficial impacts could occur if excavation reveals fossils of scientific significance that would otherwise have remained buried and unavailable for scientific study. Newly discovered fossils would be properly collected and catalogued into the collections of a museum repository so that associated geologic data are preserved and the fossils are available for future scientific study.

With the implementation of the mitigation measures described in Chapter 2.0, as well as those accepted by the BLM from the paleontology report (EVG and TRC Mariah Associates Inc. 2000), potential adverse impacts to fossil resources would be less than significant.

4.1.4.2 The No Action Alternative

Under the No Action Alternative, there would be no construction at this time and paleontological resources would remain unchanged from their existing condition except as modified by natural causes or otherwise impacted by other activities.

4.1.4.3 Mitigation

No additional mitigation beyond what is accepted by BLM from the paleontology report (EVG and TRC Mariah Associates Inc. 2000) is recommended.

4.1.4.4 Cumulative Impacts

Substantial development is occurring across Wyoming and along the Wasatch Front in Utah, some of which could lead to the loss of important fossil resources. For construction in areas with high paleontological potential, BLM may require predisturbance surveys and construction monitoring to avoid accidental fossil destruction. Since high potential areas would be surveyed prior to construction, if necessary, the impacts mitigated, and the standard paleontological protection stipulations applied, cumulative loss of paleontological resources would be minimal.

4.1.4.5 Unavoidable Adverse Impacts

A limited amount of illegal collecting could result from improved access to the VBPA, and fossils could be damaged by accidental contact during construction.

4.1.5 Mineral Resources

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a) and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with mineral resources:

- provide for leasing, exploration, and development of oil and gas, while protecting other resource values;
- coordinate land use decisions with economic factors and needs;
- plan land use consistent with the orderly development, use, and conservation of renewable and nonrenewable natural resources; and
- plan uses that encourage the conservation of energy.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.15.1 The Proposed Action

The federal government has leased the federal mineral estate in the VBPA to achieve maximum recovery of the mineral resource to meet present and future demands for natural gas, to obtain a 12.5% federal royalty to the federal government, and in response to the *Clean Air Act* amendments of 1990, to minimize air pollution. Implementation of the Proposed Action would result in the recovery of gas and oil reserves from the Wasatch, Entrada, and Nugget formations, the Mesaverde Group (Almond Formation), and possibly other formations underlying the project area. The Proposed Action would not interfere with the recovery of coal, oil shale, trona, and other minerals in the VBPA because these minerals are not available in minable quantities. Sand, gravel, and zeolite resources on or near the VBPA would still be available for recovery.

4.15.2 No Action Alternative

Under the No Action Alternative, the natural gas reserves proposed for recovery in the Proposed Action would not be recovered at this time, but would be available at some later date. However, natural gas reserves being tapped by existing wells in the VBPA would continue to be recovered. The No Action Alternative would violate the contractual agreement between the U.S. and the lessees and would be outside the jurisdiction of the BLM to implement the No Action Alternative without Congressional authorization.

4.15.3 Mitigation

The BLM may require that disturbance from gravel pits be limited to 5.0 acres at any one time.

4.1.5.4 Cumulative Impacts

The CIAA for mineral resources is the VBPA. Natural gas reserves would be recovered from developed portions of this area, as would associated oil reserves, in compliance with BLM policy. Cumulative impacts to mineral resources would be the same as described for the Proposed Action.

4.1.5.5 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to mineral resources.

4.1.6 Soils

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a), Standards for Healthy Rangelands (1997b), and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with soils:

- to stabilize and conserve soils;
- to protect the land from soil erosion;
- to control flood and sediment damage from natural or human-induced causes;
- to maintain soil cover and productivity where they are adequate;
- to increase soil cover and vegetation productivity where they are in a downward trend;
- to improve forage production and ecological conditions for the benefit of livestock use, wildlife habitat, watershed, and riparian habitat;
- to restore, maintain, or improve riparian habitat to enhance forage conditions, wildlife habitat, and stream quality;
- to achieve PFC or better on riparian areas;
- to protect, maintain, or improve wetlands, floodplains, and riparian areas;

- to ensure that riparian and wetland vegetation is capable of recovering from natural and human disturbance in order to provide for sediment capture; and
- to ensure that soils are stable and allow for water filtration to provide for optimal plant growth and minimal surface runoff.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.1.6.1 The Proposed Action

The Proposed Action would result in an additional 505 acres of new and 165 acres of LOP disturbance in the VBPA, bringing the total area of disturbance to 1,388 acres and 1,048 acres, or 1.5% and 1.1% of the VBPA, respectively. Approximately 73% (371 acres) of the new disturbance would be short-term (i.e., reclaimed and reseeded within 2 years of disturbance), whereas the remaining 165 acres would remain disturbed for the LOP. New disturbance would be greatest in the Alkali Creek tributary watershed where an estimated 194.5 acres of new short-term disturbance and 55.7 acres of new LOP disturbance would occur (39% of the total new and LOP) (Table 4.2). Approximately 70.7 acres of new disturbance and 23.4 acres of LOP disturbance would occur within the AC-8 sub-watershed of the Alkali Creek tributary watershed (14% of the total new and LOP disturbance).

Direct impacts to soils would include removal of vegetation, exposure of the soil, mixing of soil horizons, loss of topsoil productivity, soil compaction, and increased susceptibility to wind and water erosion. These impacts could, in turn, result in increased runoff, erosion, and sedimentation into the Colorado River system. The danger of increased surface runoff and erosion would be greatest in the short-term after surface disturbance activities would occur and would decline over time due to natural stabilization through particle aggregation, soil structure development, and armoring. Short-term control of surface runoff would be accomplished by implementing reclamation and revegetation efforts described in Surface Use Plans or Plans of Development prepared for each APD and/or ROW application, and

Table 4.2 Acreage of New and LOP Disturbance in Sub-watersheds, Vermillion Basin Project Area, Sweetwater County, Wyoming, 2000.

Tributary/ Sub-watershed	Acres Within VBPA	New Disturbance		LOP Disturbance	
		Acres	% of Sub-watershed	Acres	% of Sub-watershed
Vermillion Creek					
VC-1	3,289.5	17.7	0.5	5.9	0.1
VC-2	2,195.1	0.0	0.0	0.0	0.0
VC-3	473.6	0.0	0.0	0.0	0.0
VC-4	550.4	0.0	0.0	0.0	0.0
VC-5	1,260.8	0.0	0.0	0.0	0.0
VC-6	1,075.2	8.8	0.8	3.0	0.2
VC-7	2,316.7	0.0	0.0	0.0	0.0
VC-8	3,071.9	0.0	0.0	0.0	0.0
VC-9	3,219.1	0.0	0.0	0.0	0.0
VC-10	1,145.6	0.0	0.0	0.0	0.0
VC-11	2,732.7	0.0	0.0	0.0	0.0
Subtotal	21,330.6	26.5	0.1	8.9	<0.1
Alkali Creek					
AC-1	998.4	0.0	0.0	0.0	0.0
AC-2	2,195.1	0.0	0.0	0.0	0.0
AC-3	3,001.5	0.0	0.0	0.0	0.0
AC-4	2,284.7	0.0	0.0	0.0	0.0
AC-5	2,419.1	0.0	0.0	0.0	0.0
AC-6	2,047.9	44.2	2.2	14.7	0.6
AC-7	1,465.5	17.7	1.2	5.9	0.3
AC-8	2,643.1	70.7	2.7	23.4	0.7
AC-9	998.4	35.4	3.5	11.7	1.0
AC-10	1,004.8	0.0	0.0	0.0	0.0
AC-11	2,790.3	0.0	0.0	0.0	0.0
AC-12	1,107.2	0.0	0.0	0.0	0.0
AC-13	384.0	0.0	0.0	0.0	0.0
AC-14	729.6	0.0	0.0	0.0	0.0
AC-15	3,660.7	26.5	0.7	8.9	0.2
AC-16	294.4	0.0	0.0	0.0	0.0
Subtotal	28,024.7	194.5	0.7	55.7	0.2
Horseshoe Wash					
HW-1	2,195.1	0.0	0.0	0.0	0.0
HW-2	3,065.5	26.5	0.9	8.9	0.2
HW-3	2,931.1	17.7	0.6	5.9	0.2
HW-4	812.8	0.0	0.0	0.0	0.0
HW-5	812.8	0.0	0.0	0.0	0.0
HW-6	736.0	0.0	0.0	0.0	0.0
HW-7	1,030.4	0.0	0.0	0.0	0.0
HW-8	1,036.8	0.0	0.0	0.0	0.0
Subtotal	12,620.5	44.2	0.4	14.8	0.1

Table 4.2 (Continued)

Tributary/ Sub-watershed	Acres Within VBPA	New Disturbance		LOP Disturbance	
		Acres	% of Sub-watershed	Acres	% of Sub-watershed
Canyon Creek					
CYC-1	2,310.3	8.8	0.4	3.0	0.1
CYC-2	1,075.2	8.8	0.8	3.0	0.2
CYC-3	902.4	0.0	0.0	0.0	0.0
CYC-4	512.0	0.0	0.0	0.0	0.0
CYC-5	249.6	0.0	0.0	0.0	0.0
CYC-6	172.8	0.0	0.0	0.0	0.0
CYC-7	550.4	0.0	0.0	0.0	0.0
CYC-8	550.4	18.8	3.4	3.0	0.4
Subtotal	6,323.1	36.5	0.4	9.0	0.1
Granary Draw					
GD-1	1,465.5	26.5	1.8	8.9	0.5
GD-2	1,638.3	0.0	0.0	0.0	0.0
GD-3	1,663.9	8.8	0.5	3.0	0.1
GD-4	3,827.1	70.7	1.8	23.4	0.5
GD-5	953.6	35.4	3.7	11.7	1.0
Subtotal	9,548.4	141.4	1.5	47.0	0.4
South Granary Draw					
SGD-1	2,195.1	0.0	0.0	0.0	0.0
SGD-2	1,638.3	17.7	1.1	5.9	0.3
SGD-3	1,465.5	17.7	1.2	5.9	0.3
SGD-4	1,273.6	0.0	0.0	0.0	0.0
Subtotal	6,572.5	35.4	0.5	11.8	0.1
Chicken Creek					
CC-1	1,465.5	26.5	1.8	8.9	0.5
CC-2	1,171.2	0.0	0.0	0.0	0.0
CC-3	953.6	0.0	0.0	0.0	0.0
CC-4	1,248.0	0.0	0.0	0.0	0.0
Subtotal	4,838.3	26.5	0.5	8.9	0.1
Shell Creek					
SC-1	1,465.5	0.0	0.0	0.0	0.0
SC-2	729.6	0.0	0.0	0.0	0.0
SC-3	819.2	0.0	0.0	0.0	0.0
Subtotal	3,014.3	0.0	0.0	0.0	0.0
Closed Basin					
CB-1	70.4	0.0	0.0	0.0	0.0
CB-2	147.2	0.0	0.0	0.0	0.0
Subtotal	217.6	0.0	0.0	0.0	0.0
Total	92,492.0	505.0	0.5	165.0	0.1

by implementing SWPPPs. Reclamation and revegetation procedures would be designed to reduce the susceptibility of disturbed areas to soil erosion in both the short term and for the LOP. The potential for soil contamination due to the accidental spills would be limited by appropriate project implementation procedures and the remedial measures applied as specified in SPCC Plans (see Section 4.7). Applicant-committed practices to protect soils include minimizing disturbance, avoidance of steep slopes, use of best management practices for reclamation and revegetation (including the ripping of compacted soils), and preparation of SWPPPs (see Sections 2.1.13.5 and 2.1.13.6).

4.1.6.2 No Action Alternative

Under the No Action Alternative, impacts to soils in the VBPA would continue to occur at current rates. However, impacts to soils under this alternative could increase from those of the Proposed Action because of the absence of coordinated reclamation and transportation plans.

4.1.6.3 Mitigation

In addition to the applicant-committed measures presented in Section 2.1.13.5, the BLM may require the following mitigation measures:

- development of an Erosion Control, Revegetation, and Restoration Plan (ECRRP) for each APD that would identify steep slopes, erosive soils, and saline/alkaline soils and propose reclamation procedures to minimize the adverse impacts that such conditions would pose;
- salvage of topsoil (up to 12 inches) from well pads, pipelines with trenches exceeding 18 inches in depth (at least over the trench and working side), and on all areas where grading is required;
- ripping, discing, or chiseling of all compacted surfaces to a depth of 12-18 inches to reduce soil density and increase infiltration and root penetration;

- design of roads on a site-specific basis;
- restrict project-related traffic during periods when soils are saturated and rutting in excess of 4 inches could occur;
- development and implementation of a maintenance and upgrade schedule for all existing roads, with maintenance responsibilities to include, but not be limited to, grading, graveling, installing sediment control and runoff structures, and dust abatement in order to maintain all-weather drivability while minimizing erosion;
- limiting disturbance from gravel pits to 5.0 acres at any one time;
- regular erosion monitoring in subwatersheds with the highest percentage of disturbance (see Table 4.2) and if monitoring shows erosion increases beyond natural rates, Operators may be required to coordinate with the BLM to further mitigate erosion;
- design of road crossings and culverts to mitigate concentrated runoff and to reduce runoff velocity, including the armoring of all culvert outlets, diversion of upslope runoff from roads with water diversion ditches, and the use of erosion control matting or other soil stabilizing methods, as necessary, on steeper disturbed slopes and road cuts;
- during interim reclamation on producing locations, well pads be reclaimed as close as possible to the original contours;
- cut-and-fill slopes be reduced to a 3:1 slope or less where feasible;
- slopes and topsoil stockpiles be seeded as soon as the dirt work is completed;
- topsoil stockpiles not be higher/deeper than 6 ft;
- producing locations have zero runoff until adjacent disturbed areas are revegetated so as to avoid contamination and sedimentation downstream;
- all unused portions of the location be recontoured and the topsoil respread if possible;

- fencing of well pads for interim reclamation at a producing well, permanent reclamation at an abandoned and plugged well, and buried pipeline drainage crossings be necessary for a minimum of 3 years;
- berms not be allowed over pipelines in anticipation of subsidence (berms tend to concentrate runoff leading to gully formation) and pipeline trench backfill not extend above the original ground level;
- an impervious liner under some or all tank batteries;
- the option of using surface pipelines in selected areas would be considered, especially for lines with a diameter of 4 inches or less; and
- the BLM may require that all temporary water supply pipelines be located within road or gathering system pipeline ROWs.

These measures may be applied as specified in APD and ROW application Surface Use Plans and/or Plans of Development. The BLM also may conduct quality assurance reviews to ensure compliance with approved APDs and ROWs. In addition, the BLM may require Operators to restrict project-related travel on VBPA roads during periods when soils are saturated and rutting could occur.

4.1.6.4 Cumulative Impacts

The CIAA for soils is the Vermillion Creek watershed that drains the VBPA. The VBPA includes 15% of the 616,301 acre Vermillion Creek watershed. Existing disturbance within the VBPA covers 1,105 acres due almost entirely to well locations, roads, and pipeline ROWs. Additional disturbance of unknown quantity occurs downstream from the VBPA in Colorado. Future disturbance within the Vermillion Creek watershed includes 505 acres associated with the Proposed Action--505 acres of short-term disturbance and 165 acres of long-term disturbance--0.08% and 0.02% of Vermillion Creek watershed, respectively. It is likely that some unknown quantity of additional disturbances will occur elsewhere in the watershed, but the amount is unknown.

4.1.6.5 Unavoidable Adverse Impacts

Productivity of some disturbed soils would be reduced due to removal of vegetation, exposure of the soils, mixing of soil horizons, and increased susceptibility to wind and water erosion, and some increased soil loss through erosion would be unavoidable under the Proposed Action.

4.1.7 Water Resources

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a), Standards for Healthy Rangelands (BLM 1997b), and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with water resources:

- to ensure water quality meets state standards;
- to protect surface and ground water resources from degradation;
- to meet or exceed established standards for quality of surface and ground water where water quality has been lowered by human-induced causes;
- to provide for physical and legal availability of water for use by the public and by federal, state, and local agencies for fisheries and wildlife and for livestock, recreational, municipal, and industrial uses;
- to reduce salt loading in watersheds that lie within the Colorado Basin;
- to conserve water and relate water resources and development to desired land use;
- to conserve surface water quality of local streams;
- to improve forage production and ecological conditions for the benefit of livestock use, wildlife habitat, watershed, and riparian habitat;
- to restore, maintain, or improve riparian habitat to enhance forage conditions, wildlife habitat, and stream quality;
- to achieve proper functioning condition or better on riparian areas;
- to maintain or improve surface and ground water quality;

- to protect, maintain, or improve wetlands, floodplains, and riparian areas;
- to ensure that riparian and wetland vegetation is resilient and capable of recovering from natural and human disturbance in order to provide for sediment capture, energy dissipation, and ground water recharge; and
- to ensure that soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.1.7.1 The Proposed Action

The Proposed Action would result in an additional 505 acres of new initial surface disturbance and 165 acres of LOP disturbance, bringing the total project-required disturbance in the VBPA to 1,388 acres and 1,048 acres, or 1.5% and 1.1% of the VBPA, respectively. The likelihood that erosion and runoff-related problems could occur would be increased if surface disturbance were to be concentrated in any one sub-watershed, and this would require special treatments specified during the APD approval process. New disturbance would be greatest within the Alkali Creek tributary watershed--especially in the AC-8 sub watershed--where 194.5 acres and 70.7 acres, respectively, are proposed for disturbance (see Table 4.2). However, total and LOP disturbance in any sub-watershed would not exceed 3.7% and 1.0%, respectively.

Potential impacts to surface water resulting from the Proposed Action include increased turbidity, salinity, and sedimentation due to increased runoff and erosion from disturbed areas, accidental spills of petroleum products or other pollutants, and discharge of produced water and/or pipeline test water of poor quality. Rates of wind and water erosion would increase above natural rates until successful reclamation of disturbed areas is achieved; however, the increase would be minimized because of the implementation of applicant-committed practices and mitigation measures described elsewhere in this document. These measures include proper facility siting, including avoidance of riparian areas and floodplains, use of best management practices, and ensuring proper reclamation and revegetation (see Sections 2.1.13.5 and 2.1.13.6).

Springs and seeps in the area could be adversely affected (e.g., reduced flows, possible contamination) where development occurs in source areas. However, proper erosion control, well site locations, hazardous material containment, and well casing requirements are anticipated to keep potential impacts to springs and seeps at less than significant levels.

Flood-prone areas would be avoided, where practical, and impacts associated with flooding are not anticipated. There would be no depletion of surface waters associated with the Proposed Action, and with successful reclamation, only a very minor amount, if any, project-related sedimentation would reach the Colorado River.

Potential impacts to ground water from the Proposed Action include consumption during drilling and completion operations; contamination of shallow aquifers from drilling, fracturing fluids, and/or produced water; and cross-aquifer mixing through the well bore. Minimization of these potential impacts would be accomplished by implementing applicant-practices (see Section 2.1.13.6), which include cementing of the well bore and implementation of spill prevention and countermeasure plans.

4.1.7.2 No Action Alternative

Under the No Action Alternative, there would be no additional development activities that would affect surface or ground water resources.

4.1.7.3 Mitigation

The BLM may require:

- the lining of all reserve pits and some or all tank batteries;
- drilling and/or fracturing fluids be hauled from locations and reused for drilling or fracturing another well;
- all fracturing fluids flowed-back to the surface be contained in tanks prior to removal from the location;
- Operators, in cooperation with BLM, to identify source areas and associated structural controls (stratigraphically or fault controlled) for areas where springs and seeps occur during APD on-site inspections;
- well locations be situated outside of spring and seep source areas, where practical;
- well locations be located more than 500 ft from perennial drainages and 100 ft from intermittent/ephemeral drainages;
- regular erosion monitoring in subwatersheds with the highest percentage of disturbance (see Table 4.2) and if monitoring shows erosion increases beyond natural rates, Operators may be required to coordinate with the BLM to further mitigate erosion;
- additional protection measures (e.g., disturbance acreage limitations, closed mud systems) where locations are built in source areas; and
- Operators to periodically monitor seep and spring flow rates and water quality if actions are occurring within source areas.

4.1.7.4 Cumulative Impacts

The CIAA for surface water is the Vermillion Creek watershed. Impacts would primarily be increases in runoff and sediments, as described for soils (see Section 4.1.6.4). These impacts would be minimal due to applicant-committed practices and mitigation measures.

Other unquantified impacts to the Vermillion Creek watershed may occur downstream in Colorado.

The CIAA for ground water is the VBPA. Pit lining, as necessary, and isolation of aquifers by cementing portions of the well bore would prevent ground water contamination.

4.1.7.5 Unavoidable Adverse Impacts

Some increased runoff and sediments would likely reach local waterways.

4.1.8 Noise and Odor

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a) and state (WSLUC 1979) and local (SCBC 1996) land use plans do not specify any management objectives specifically associated with noise and odor. For the purposes of this EA, significant noise impacts would occur if long-term project-related activities result in exceeding the federal dBA maximum standard for noise at residences and other noise-sensitive locations (i.e., sage grouse leks during the breeding season, raptor nests during breeding and nesting seasons, and big game crucial range during critical winter periods). Odors produced by project-related activities would be significant if they caused current VBPA users to utilize locations outside the project area to avoid exposure to such odors.

4.1.8.1 The Proposed Action

Drilling rig and flaring operations would produce temporary noise levels of up to 115 dBA at the source, with noise levels of 55 dBA at 3,500 ft from the source (BLM 1991b). These activities would be the loudest project-related noise-producing operations and would continue 24 hrs/day for approximately 20 days at each location. Increased noise levels associated with construction activities likely would range from 70 to over 90 dBA within

50 ft of the activity and would be produced by earthmoving equipment and large trucks. However, these noise levels would be temporary, would attenuate with distance at a rate of approximately 6 dBA with each doubling of distance (Thumann and Miller 1986), and would be mitigated with the applicant-committed practices of using proper operating techniques and maintenance of manufacturer-installed noise abatement equipment (see Section 2.1.13.7).

Compressor engines would generate about 92 dBA at 10 ft (55 dBA at 600-700 ft), and the air intakes would generate about 119 dBA at 3 ft (55 dBA at 3,000 ft). These noise levels are for unhoused and unmuffled compressors, and would be reduced by housing the compressors and by the installation of silencers on exhaust stacks. Compressor engine noise would occur throughout the LOP. Noise levels associated with production operations at each well pad would be minimal, since no pumping is required.

There are no humans residing within several miles of the VBPA; therefore, there would be no impacts to humans other than workers in close proximity to construction, drilling, or compressor station activities--workers who would observe safety precautions associated with work activities in high noise areas. Potential impacts of noise to wildlife are discussed in Section 4.2.2.

Increased noise levels associated with drilling rigs, completion activities, and other construction equipment employed during peak activity periods would be short-term at any given location, but would continue throughout the LOP--especially during the first 10-15 years when well locations would be developed. Increased noise from compression and traffic would continue throughout the LOP.

Odors present periodically at well and ancillary facility locations and along roadways could offend area users in the immediate vicinity of odor sources. However, such odors would be dispersed by the wind.

4.1.8.2 No Action Alternative

There would be no additional noise or odors produced under the No Action Alternative. Existing conditions would continue for the foreseeable future.

4.1.8.3 Mitigation

No additional mitigation is recommended.

4.1.8.4 Cumulative Impacts

The CIAA for noise and odor is the VBPA and a 1-mi buffer, which would include any noise- or odor-sensitive receptors. Neither project-related noise nor odors would be detected more than 1 mi from the VBPA, and in most cases would be confined within the VBPA because of mitigation measures, noise attenuation, and odor dispersion by the wind.

4.1.8.5 Unavoidable Adverse Impacts

The Proposed Action would result in some additional noise and odors within the VBPA. Most sources of noise above ambient levels would be short-term, and odors would be quickly dispersed by the wind.

4.2 BIOLOGICAL RESOURCES

4.2.1 Vegetation and Wetlands

The management objective for vegetation resources per the GRRA RMP and ROD (BLM 1992, 1996a, 1997a), Standards for Healthy Rangelands (BLM 1997b), and state (WSLUC 1979) and local (SCBC 1996) land use plans are:

- to maintain or enhance vegetation community health, composition, and diversity in order to meet watershed, wild horse, and wildlife resource management objectives;
- to provide for plant diversity (desired plant communities) to meet livestock management, watershed, wild horse, and wildlife objectives;
- to improve forage production and ecological conditions for the benefit of livestock use, wildlife habitat, watershed, and riparian habitat;
- to restore, maintain, or improve riparian habitat to enhance forage conditions, wildlife habitat, and stream quality;
- to achieve PFC or better on riparian areas;
- to maintain or improve surface and ground water quality;
- to protect, maintain, or improve wetlands, floodplains, and riparian areas;
- to ensure soils are stable and provide for optimal plant growth;
- to sustain rangelands capable of supporting viable populations and a diversity of native plant species; and
- to ensure upland vegetation consists of plant communities appropriate to each ecological site that are resilient, diverse, and able to recover from all natural and human disturbance.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.2.1.1 The Proposed Action

Under the Proposed Action, 505 acres of new project-required disturbance would result in the removal of existing--and generally native--vegetation, representing approximately 0.5% of the VBPA (Table 2.1). An additional 883 acres of existing disturbance would be utilized by the proposed project, bringing the total disturbed area used for project-related activities to 1,388 acres. Approximately 67% (340 acres) of the 505 acres of new disturbance would be reclaimed and revegetated with native species shortly (3-5 years) after disturbance, whereas the remaining 165 acres (0.1% of the VBPA) would remain unreclaimed for the LOP. Areas of short-term disturbance would produce less forage for a few years until revegetation is successful, at which time grasses and possibly forbs would become more dominant and likely would be more productive than prior to disturbance (see Section 4.5.1, Livestock Grazing). Shrubs would take 20 years or more to reach predisturbance conditions. Short-term disturbance would be spread over the 10-15 year development period and would be scattered throughout the VBPA in small parcels, so that relatively few areas of small size would be disturbed in any one year. After a few years, much of the short-term disturbance would be revegetated and producing forbs and grasses, so that at no time would the entire 1,388 acres be out of production. All the vegetation types that would be disturbed in the VBPA are common throughout undisturbed portions of the area as well as on surrounding lands. No uncommon or unique vegetation types would be removed by project-related activities, and the avoidance of wetland areas coupled with appropriate reclamation would minimize effects to these areas. Habitat suitable to the invasion of noxious weeds and other undesirable annuals would be created as a result of removal of existing vegetation; however, measures would be taken to control such invasions (see Section 2.1.13.8, item 6). None of the management objectives for vegetation would be violated, and no significant impacts to vegetation would occur.

4.2.1.2 No Action Alternative

Under the No Action Alternative, impacts to vegetation would continue at approximately existing levels. However, impacts to vegetation under this alternative could be increased from those of the Proposed Action due to the absence of coordinated reclamation and transportation planning efforts.

4.2.1.3 Mitigation

The BLM may request Operator assistance in monitoring reclaimed areas, may require that all temporary water supply pipelines be located within road or gathering system pipeline ROWs, and may require that disturbance from gravel pits be limited to 5.0 acres at any one time.

4.2.1.4 Cumulative Impacts

The CIAA for vegetation is the VBPA. The Proposed Action, added to existing disturbance to vegetation, would mean an increase of 505 acres in the short term and 165 acres in the long term, 0.5% and 0.2% of the VBPA, respectively. All disturbed areas would be reclaimed with native vegetation after the LOP.

4.2.1.5 Unavoidable Adverse Impacts

The Proposed Action alternative would remove vegetation on 0.5% of the VBPA in the short term, and on 0.2% of the VBPA for the LOP, and could provide habitat conducive to the invasion of undesirable plant species. However, weed abatement procedures are in place to limit such occurrences.

4.2.2 Wildlife and Fisheries

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a), Standards for Healthy Rangelands (BLM 1997b), and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with wildlife and fisheries:

- to maintain, improve, or enhance the biological diversity of plant and wildlife species while ensuring healthy ecosystems;

- to restore disturbed or altered habitat with the objectives to attain desired native plant communities, while providing for wildlife needs and soil stability;
- to enhance or maintain riparian habitats by managing deep-rooted native herbaceous or woody vegetation;
- to provide habitat quality (food, cover, space, and water) adequate to support a natural diversity of wildlife and fisheries, including big game; upland game; waterfowl; nongame species; game fish; TEP&C and sensitive species; and species of special management interest in Wyoming; as well as to assist in meeting goals of recovery plans;
- to maintain or improve overall ecological quality, thus providing good wildlife habitat, within the constraints of multiple-use management in moderate and low-priority standard habitat sites;
- to promote the sound management of wildlife to achieve the optimum mix of species and habitat, including the reduction of numbers where severe overpopulation competes with agriculture;
- to protect unique natural areas and endangered wildlife species by encouraging development that reduces unfavorable impacts on fragile areas;
- to conserve the crucial winter range of big animals;
- to integrate the consideration of crucial winter ranges for big game animals into future land management decisions;
- to improve forage production and ecological conditions for the benefit of livestock use, wildlife habitat, watershed, and riparian habitat;
- to restore, maintain, or improve riparian habitat to enhance forage conditions, wildlife habitat, and stream quality;
- to manage resources so that productivity of nesting raptor pairs is maintained, while allowing for development of oil and gas, and to seek the cooperation of owners of adjacent property in management of raptor nesting habitat;
- to maintain or improve vegetation condition and/or avoid long-term disturbance in high-priority standard habitat sites and fisheries areas; and

- to sustain rangelands capable of supporting viable populations and a diversity of animal species.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.2.2.1 The Proposed Action

Impacts to wildlife would result from the direct loss of habitat due to vegetation removal; displacement of wildlife due to disturbance by project-related activities (construction, drilling, traffic, etc.), especially on crucial winter ranges; direct mortality due to project activities such as construction of roads and well pads; increased mortality due to poaching and harassment; and an increased likelihood of vehicle/animal collisions due to increased traffic.

Pronghorn. Under the Proposed Action, vegetation would be removed from approximately 159 acres of crucial pronghorn winter range due to the construction of 18 wells–9 acres in the South Rock Springs herd and 150 acres in the Bitter Creek herd (Table 4.3). This represents 0.2% of the crucial winter/yearlong range in the South Rock Springs herd within the VBPA and 0.3% of the crucial winter/yearlong range in the Bitter Creek herd within the VBPA. Total LOP new disturbance, combined with the existing disturbance to be used for the Proposed Action, would disturb 0.2% of crucial winter/yearlong range in the South Rock Springs herd within the VBPA and 1.4% of crucial winter/yearlong range in the Bitter Creek herd within the VBPA. This represents 0.01% and 0.03% of crucial winter/yearlong range in the entire South Rock Springs and Bitter Creek herds, respectively. Of the 159 acres of crucial range from which vegetation would be removed, 107 acres (67%) would be reclaimed and revegetated shortly after disturbance; however, these areas would produce less forage for a few years until revegetation is successful, at which time grasses and forbs would become more dominant and likely would be more productive than pre-disturbance vegetation (see Section 4.2.2.1). Shrubs would take 20 years or longer to reach

Table 4.3 Existing and Proposed Disturbance in Big Game Ranges, Vermillion Basin Project Area, Sweetwater County, Wyoming.

	Acres of Disturbance				
Species/Herd/Range	Existing (% of range in VBPA)	Proposed Short-Term (% of range in VBPA)	Proposed LOP (% of range in VBPA)	Total LOP (% of range in VBPA)	% of Range in Herd Unit
Pronghorn					
South Rock Springs Herd					
Crucial winter/yearlong	11 (0.2)	9 (0.2)	2 (0.04)	13 (0.2)	0.01
Spring/summer/fall	44 (1.0)	0	0	44 (1.0)	0.01
Bitter Creek Herd					
Crucial winter/yearlong	667 (1.3)	150 (0.3)	50 (0.11)	723 (1.4)	0.3
Winter/yearlong	383 (0.9)	346 (0.9)	112 (0.25)	490 (1.2)	0.03
Mule Deer					
South Rock Springs Herd					
Winter/yearlong	1,105 (1.2)	505 (0.5)	165 (0.1)	1,270 (1.3)	0.02

predisturbance conditions. Short-term disturbance would be scattered throughout the VBPA in small parcels, so that a relatively few areas of small size would be disturbed in any one year. After a few years, much of the disturbed land would be revegetated and producing forbs and grasses to supply seasonal forage. At no time would the entire 159 acres of crucial pronghorn winter range be out of production. Applicant-committed practices to minimize impacts to pronghorn from loss of vegetative cover include minimization of vegetation removal and disturbance and prompt reclamation and revegetation of disturbed areas not required for LOP operations.

Approximately 38 wells and associated roads/pipelines would disturb approximately 346 acres of winter/yearlong pronghorn range in the Bitter Creek Herd Unit in the short-term–0.9% of such range within the VBPA (Table 4.3). LOP disturbance to winter/yearlong range in the Bitter Creek herd within the VBPA, including existing disturbance that would be used for the Proposed Action, would be 490 acres (1.2% of such range in the VBPA and 0.03% of such range in the entire Bitter Creek herd unit. LOP disturbance to crucial winter/yearlong range in the Bitter Creek herd within the VBPA, including existing disturbance that would be used for the Proposed Action, would be 773 acres (1.4% of such range in the VBPA and 0.3% of such range in the entire Bitter Creek herd unit).

There would be approximately 44 acres of existing disturbance in spring/summer/fall range in the South Rock Springs herd unit utilized for the Proposed Action, representing approximately 1.0% of such range in the VBPA and 0.01% of such range in the entire herd unit.

In addition to the direct loss of habitat due to construction of wellpads, pipelines, roads, and associated facilities, disturbance from drilling activities and traffic would affect utilization of habitats immediately adjacent to these areas. Pronghorn have been found to habituate to increased traffic volumes (Reeve 1984) and heavy machinery as long as the machinery moves in a predictable manner. Deviations from the ordinary causes antelope displacement (Segerstrom 1982). Some unquantifiable amount of displacement of pronghorn would undoubtedly occur, resulting in reduced use of existing habitat. Highest levels of displacement would likely occur during construction and drilling when human activities occur at their highest levels. Based on studies (Gusey 1986; Guenzel 1986, 1987; and Easterly et al. 1991), displacement likely would be about 0.5 mi. During the production phase of the project, pronghorn would likely become habituated to equipment and facilities and would utilize habitats immediately adjacent to wells and within reasonable distances of compressor stations.

Increased mortality from vehicle/animal collisions is a potential direct impact that may occur due to increased traffic in the project area for the LOP. Increased access to big game range may increase legal and illegal harvest by providing additional opportunities for humans to come into contact with animals. On the other hand, some people may be deterred from poaching because of the greater access and likelihood of being observed by other area users. Operators would implement policies to control poaching/harassment of wildlife and to minimize animal/vehicle collisions (see Section 2.1.13.9).

Pronghorn move through the VBPA on their way to and from crucial winter habitats; however, because only 0.5% of the VBPA would be disturbed, it is unlikely that project development would interfere with pronghorn seasonal movements.

Impacts to pronghorn are not anticipated to be significant.

Mule Deer. All disturbance within the VBPA would occur within mule deer winter/yearlong range. No crucial mule deer range occurs on the VBPA. Impacts to mule deer would be of the same general nature as to pronghorn, and would not be significant because of their limited nature. Total LOP disturbance to mule deer winter/yearlong range would represent 1.3% of such range in the VBPA and 0.02% of such range in the entire herd unit.

Other Mammals. Direct impacts to other mammals would include direct mortality during construction and a potential increase in mortality from vehicle/animal collisions. Most small mammal species are relatively tolerant of human activity and likely would experience reduced populations in direct proportion to the amount of habitat removed. This would most likely be true for species with relatively small home ranges (rodents, lagomorphs, etc.), and would be less applicable to more wide-ranging species such as coyote. Project impacts to small mammals would likely be masked by natural variations in populations due to weather, disease, and other natural factors. Total project-required surface disturbance represents 0.5% of the VBPA, and only a portion of this area would be disturbed at any one time. Rare habitats (e.g., springs, wetlands and riparian areas) would be avoided, where possible, and applicant-committed practices to minimize impacts to wildlife would reduce impacts.

Raptors. Factors potentially resulting in decreased raptor reproductive success from the presence of increased human activities in the area include nest and/or area abandonment, damage to eggs or young from frightened adults, overexposure of eggs or young to heat or cold, missed feedings, premature fledging, and increased predation. The potential for these impacts would be greatest during project construction (10-15 years), when human activity levels are greatest; the potential for these types of impacts would be reduced during production (40-50 years). Applicant-committed practices to avoid impacts to raptors include establishing a 0.5-mi radius buffer zone around active raptor nests (1.0 mi for ferruginous hawks) during the nesting season, as well as an 825-ft exclusion zone around active raptor nests for development of facilities that require repeated human presence (see Section 2.1.13.9). Spatial and temporal buffer zones would provide seasonal protection of raptor nests from human activities; however, nothing would prevent development within the buffer zone (except the 825-ft exclusion zone) outside of the nesting season, and activities associated with such development (e.g., well maintenance actions, traffic) could disturb nesting raptors during subsequent nesting seasons.

Reduction in raptor prey species would be minimized by the applicant-committed practices in Section 2.1.13.9 as well as practices to minimize surface disturbance and ensure timely reclamation and revegetation. Project-related activities would disturb less than 0.5% of the entire VBPA; therefore, reductions in prey species abundance would be minimal and are not anticipated to adversely affect raptors.

Raptor surveys have not been completed on the VBPA, but will be completed site-specifically prior to disturbance. At this time, however, it appears that most known nest locations are in areas that would not be developed under the Proposed Action (see Map 3.6), and that applicant-committed measures would avoid significant impacts to raptors.

Game Birds. Two sage grouse leks are known to occur in or immediately adjacent to the VBPA (see Map 3.6). Applicant-committed practices to avoid surface disturbance within 0.25 mi of a sage grouse lek and restrict construction activities in suitable sage grouse nesting habitat within 2.0 mi of a lek during the breeding and nesting season (see Section 2.1.13.9) would hold potential impacts to sage grouse to insignificant levels. However, some disturbance of nesting sage grouse likely would occur. In addition, the 0.25-mi buffer may be inadequate to protect breeding grouse from noise impacts (e.g., individuals flushed from leks, failure of females to breed, lek abandonment), which could result in reduced breeding success.

Field development could reduce the value of some sage grouse winter habitat areas; however, suitable winter habitats for grouse would remain on and adjacent to the VBPA. Because of the limited amount of habitat that would be disturbed by project-related activities, and the fact that proposed wells are at least 1-2 mi from each of the two known sage grouse leks, impacts to sage grouse would not be significant.

Mourning doves would not be impacted by the Proposed Action because of the low level of disturbance to their habitat, their inherent mobility, and the availability of suitable habitats on undisturbed lands.

Other Birds. Nongame birds could be adversely affected by increased human activity in the project area; primary impacts would occur in direct proportion to the amount of a species' habitat that would be removed. Initial surface disturbance would be scattered throughout the VBPA in small parcels, would represent 0.5% of the project area, and would avoid rare habitats. Sixty-seven percent (340 acres) of the disturbance would be short-term. Some increased mortality would be likely from vehicle/bird collisions as a result of increased traffic. Measures already described to mitigate surface disturbances and project activities would minimize impacts to nongame birds as well. Reserve, workover, or other pits potentially hazardous to birds would be protected to prevent bird access as directed by the BLM (see Section 2.1.13.9).

Amphibians and Reptiles. Direct impacts to amphibians and reptiles likely would occur in direct proportion to the amount of their habitat disturbed. There could also be an increase in mortality due to increased traffic in the project area. Total surface disturbance to the VBPA would be approximately 0.5% of the area and would be in relatively small areas scattered in time and space over the VBPA. Sixty-seven percent (340 acres) of all disturbance would be short-term and rare habitats (e.g., wetlands, riparian areas) would be avoided. Applicant-committed measures described in Section 2.1.13.5 and 2.1.13.6 to minimize surface disturbance and ensure timely reclamation and revegetation would minimize project impacts to amphibians and reptiles.

Fisheries. No fisheries occur within the VBPA, although one fishery of regional importance is located outside (upstream) of the VBPA. The Proposed Action would not affect the upstream fishery because project related disturbances would occur downstream of this area. Applicant-committed practices to control erosion and prevent spills of hazardous materials (see Sections 2.1.13.5 and 2.1.13.17) would minimize the potential for impacts to downstream fisheries in the Colorado and Green Rivers.

4.2.2.2 No Action Alternative

Under the No Action Alternative, wildlife populations would be determined primarily by natural forces such as weather, land use, and, for game species, by WGFD regulations. However, impacts to wildlife under this alternative could be increased from those of the Proposed Action due to the absence of coordinated reclamation and transportation planning efforts.

4.2.2.3 Mitigation

As deemed appropriate by the BLM in consultation with the WGFD, additional water sources (e.g., retention of project-developed water wells) may be developed by the Operators to increase seasonal use of the area by pronghorn and sage grouse, or to hold pronghorn on the VBPA for longer periods during seasonal movements in order to reduce foraging pressure on crucial winter habitats. To provide further protection for ferruginous hawks, the BLM may require an avoidance area of 1,000 ft from active ferruginous hawk nests.

Inventory and monitoring of wildlife on the VBPA would be conducted as directed by the BLM and appropriate management decisions would be made to further protect wildlife and their habitats. The BLM may require sage grouse nest surveys prior to disturbance for developments proposed within sage grouse nesting habitat, and may require that permanent high-profile structures not be constructed within 0.25 mi of any leks (active or inactive). The BLM also may require the netting of all reserve pits.

The BLM may require that all temporary water supply pipelines be located within road or gathering system pipeline ROWs.

Additionally, BLM may require Operators to post speed-limit signs at key areas within the VBPA to minimize the potential for collisions with wildlife.

4.2.2.4 Cumulative Impacts

Pronghorn. The CIAA for pronghorn includes the entire Bitter Creek herd unit and migration corridors for the herd. The Bitter Creek herd extends into the Continental Divide/Wamsutter II project area to the northeast, which will disturb an additional 0.01% of crucial winter/yearlong range and 0.05% of winter/yearlong range, and predicts total cumulative disturbance to 0.8% and 1.1% of these ranges, respectively (BLM 1999a).

Other Mammals. The CIAA for other mammals is the VBPA and a 2-mi buffer. There is little additional disturbance anticipated in the 2-mi buffer around the VBPA other than some road upgrades that would disturb relatively small areas adjacent to existing disturbance.

Raptors. The CIAA for raptors includes the VBPA and a 1-mi buffer. There is little additional disturbance anticipated in the 1-mi buffer around the VBPA other than road upgrades that would disturb relatively small areas adjacent to existing disturbance.

Game Birds. The CIAA for sage grouse is Upland Game Bird Management Area 6. The Continental Divide/Wamsutter II (BLM 1999a) project estimates cumulative disturbance to 2,700 acres (3.7%) of sage grouse nesting habitat and 200 acres (3.6%) of potential breeding habitat within this management area. The Proposed Action combined with reasonably foreseeable development likely would result in some disturbance of nesting sage grouse, although the extent of that disturbance is unknown.

The CIAA for mourning dove is the project area and a 2-mi buffer. Little additional disturbance is anticipated in the 2-mi buffer around the VBPA, other than some road upgrades and pipeline installation that would disturb relatively small areas adjacent to existing disturbance.

Other Birds, Amphibians, and Reptiles. The CIAA for other birds, amphibians, and reptiles, is the VBPA. Little additional disturbance is anticipated in the VBPA other than some road upgrades and pipeline installations that would disturb relatively small areas adjacent to existing disturbance.

Fisheries. The CIAA for fisheries is the Vermillion Creek watershed. Affected drainages include Alkali Creek, Vermillion Creek, Horseshoe Wash, Canyon Creek, Granery Draw, and Chicken Creek, all of which are classified as Class 5 streams (WDEQ 1990)--low production waters often incapable of sustaining a trout population.

4.2.2.5 Unavoidable Adverse Impacts

Activities associated with the proposed project could interfere with successful reproduction of raptors and/or sage grouse if applicant-committed practices to protect these species are ineffective. If ponds containing hazardous materials are not netted to exclude birds, bird mortality may occur, and some additional mortality of wildlife would likely occur due to construction of facilities (wells and roads) and wildlife/vehicle collisions.

4.2.3 Wild Horses

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a) and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with wild horses:

- protect, maintain, and control viable, healthy herds of wild horses while retaining their free-roaming nature;
- provide adequate habitat for free-roaming wild horses through management consistent with environmental protection; and
- provide opportunity for the public to view wild horses.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.2.3.1 The Proposed Action

Implementation of the Proposed Action would temporarily displace wild horse bands from areas subject to disturbance. Adequate habitat exists in adjacent areas to accommodate the horses for short periods of time. The direct removal of habitat as a result of new surface disturbance due to wells, roads, and pipelines would be minimal–0.04% of the 1,193,283-acre Salt Wells WHHMA. Seed mixtures for revegetation in the VBPA would contain forbs and grasses especially palatable to wild horses, and these would benefit horses in reclaimed areas. There would be an increase in the potential for vehicle/wild horse collisions; however, such collisions are rare and would be mitigated by applicant-committed practices imposing speed limits (see Section 2.1.13.9). None of the management objectives for wild horses would be violated, and no significant impacts would occur.

4.2.3.2 No Action Alternative

No increased impacts beyond existing allowable levels would occur to wild horse populations under the No Action Alternative, although impacts to wild horses under this alternative could be increased from those under the Proposed Action because of the absence of coordinated reclamation and transportation planning efforts.

4.2.3.3 Mitigation

No additional mitigation is recommended.

4.2.3.4 Cumulative Impacts

The CIAA for wild horses is the Salt Wells WHHMA. The Continental Divide/ Wamsutter II project (BLM 1999a) estimates that 18,600 acres (3.5%) of the Salt Wells WHHMA would be disturbed by cumulative impacts. This is not considered significant because wild horse populations are above objectives and because wild horse populations and distribution is controlled by the availability of water sources.

4.2.3.5 Unavoidable Adverse Impacts

The Proposed Action would result in the loss of a small amount of wild horse habitat due to the construction of wells, roads, and pipelines.

4.2.4 Threatened, Endangered, Proposed, and Candidate Species

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a), Standards for Healthy Rangelands (1997b), and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with TEP&C and other sensitive species:

- to provide, maintain, or improve habitat through vegetative manipulation, mitigation measures, or other management actions including habitat acquisition and easements;
- maintain or enhance essential and important habitat and prevent destruction or loss of plant species communities and important habitat;
- to maintain, improve, or enhance the biological diversity of plant and wildlife species while ensuring healthy ecosystems;
- to maintain or enhance habitats that support or could support TEP&C or other sensitive species;
- to provide opportunities for enhancing or expanding the habitat;
- to prevent the need for listing species as threatened or endangered; and
- to protect unique natural areas and endangered wildlife species by encouraging development that reduces unfavorable impacts on fragile areas.

In addition, compliance with the *Endangered Species Act* would be required. Failure to comply with one or more of these management objectives, or with the *Endangered Species Act*, could result in significant impacts.

4.2.4.1 The Proposed Action

TEP&C Animal Species

The Proposed Action would result in short-term disturbance of 505 acres and LOP disturbance of 165 acres. There would be no impact to black-footed ferret from the Proposed Action because all ferrets located within the VBPA would be designated as part of a nonessential population. The nonessential experimental designation removes the restrictive regulations of the *Endangered Species Act* and allows current uses of the public land to continue without limitation (BLM 1995). Two known prairie dog towns exist within the Wyoming portion of the ExPA and within the VBPA and these colonies have been determined capable of sustaining a black-footed ferret population of 17.76 ferrets (personal communication, March 2000, Bob Luce, WGFD). No evidence of black-footed ferret occupation has been documented in the vicinity of the VBPA (CNHP 2000; WNDD 2000); and it is unlikely that black-footed ferrets currently inhabit the area.

Migrating bald eagles and those nesting or wintering along the Green River or near Flaming Gorge Reservoir occasionally may forage or fly through the VBPA; however, such use is likely intermittent and for relatively short periods. Given this intermittent use and the lack of nesting and roosting habitat in the VBPA, it is anticipated that there would be no adverse effects to this species from the Proposed Action or alternatives.

Based on plant community/habitat type data, mountain plover likely nest in the VBPA. However, implementation of the proposed species-specific mitigation measures shown in Section 2.1.13.9 would minimize the potential for direct and indirect impacts (e.g., mortality of individuals, nest failure, or abandonment) to this species. Studies and survey data show mountain plover to be generally tolerant of disturbance (USFS 1994a, 1994b). However, if mountain plover do nest in the area, disturbance of nesting habitat may preclude plovers from nesting in these areas.

Since whooping crane occurrence within the VBPA is highly unlikely, the Proposed Action is not likely to adversely affect this species.

Under the Recovery and Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (RIP), any water depletions from tributary waters within the Colorado River drainage are considered as jeopardizing the continued existence of these fish. Tributary water is defined as water that contributes to instream flow habitat. Depletion is defined as water which would contribute to the river flow if not intercepted and removed from the system. The RIP was developed as part of a cooperative effort between the states of Colorado, Utah, and Wyoming; the Bureau of Reclamation (BOR); USFWS; private water development interests; and various environmental groups. In addition, a cooperative agreement was signed by the governors of the states of Colorado, Utah, and Wyoming; the Secretary of the Interior; and the Administrator of the Western Area Power Administration, Department of Energy, to further implement the RIP. The BLM retains discretionary authority over individual projects within the area for the purpose of endangered species consultation. If the recovery program is unable to implement the RIP in a timely manner or make sufficient progress in recovery of these species, re-initiation of Section 7 consultation may be required so that new reasonable and prudent alternatives can be developed. The USFWS has determined that progress made under the RIP has been sufficient to merit a waiver of the mitigation fee for depletions of 100 acre-ft or less per year (Memorandum dated March 9, 1995, to Assistant Regional Director, Ecological Services, Region 6, from Regional Director 6, "Intra-Service Section 7 Consultation for Elimination of Fees for Water Depletions of 100 acre-ft or Less from the Upper Colorado River Basin"). No withdrawal of surface water or ground water is proposed. The Proposed Action would require approximately 189.9 acre-ft of ground water over the 10- to 20-year project development period or from 9.5 to 19.0 acre-ft per year. The Proposed Action would utilize existing water wells that currently tap water from depths of 690 to 2,540 ft. Due to the depths of ground water withdrawal, it is highly unlikely that the proposed project would affect the flow characteristics of surface water resources within and in the vicinity of the

VBPA or result in water depletions. Therefore, the proposed action is not likely to adversely affect the downstream fish species or contribute to cumulative effects, and no mitigation measures beyond the standard wetland, erosion, sedimentation, and aquatic habitat protection measures are proposed.

TEP&C Plant Species

The Wyoming population of blowout penstemon occurs on steep blowing slopes with less than 5% cover of blowout grass (*Redfieldia flexuosa*), thickspike wildrye (*Elymus lanceolatus*), lemon scurf-pea (*Psoralidium lanceolatum*), and occasional rubber rabbitbrush (*Chrysothamnus nauseosus*) (Fertig 1999). No suitable habitat for this plant species has been identified within the VBPA (personal communication, February 9, 2000, with Jim Dunder, BLM), and the potential for the species to occur in the project area is extremely low (personal communication, March 21, 2000, with Walt Fertig, Botanist, Wyoming Natural Diversity Database). Therefore, the proposed project is unlikely to adversely affect the species individually or cumulatively.

Potential habitat in the VBPA for Ute ladies' tresses is limited to riparian communities, which comprise approximately 3% of the area. However, the project-wide mitigation measures listed in Section 2.1.13.9 of this EA would ensure no adverse effects to this species.

4.2.4.2 No Action Alternative

Under the No Action Alternative, there would be no additional activities potentially affecting TEP&C species. However, impacts to TEP&C species under this alternative could be increased from those of the Proposed Action due to the absence of coordinated reclamation and transportation planning efforts.

4.2.4.3 Mitigation

The BLM may require black-footed ferret searches prior to development in accordance with USFWS guidelines (USFWS 1989).

4.2.4.4 Cumulative Impacts

The Proposed Action would likely have no additional impacts (unlikely to adversely affect) to existing cumulative effects on black-footed ferret habitat from oil and gas development, ranching, hay production, and transportation and on prairie dogs from pest control and recreational shooting. Similarly, there would be no increase in cumulative impacts to whooping crane or its preferred habitat due to the proposed project. Cumulative impacts to eagles resulting from this project in combination with other regional oil and gas development, urban expansion, and roads projects would result in some additional foraging habitat loss, but large areas would remain available to eagles, and cumulative impacts are unlikely to adversely affect the species. Also, all development activities (including the Proposed Action) would avoid winter roosts and active nests, further minimizing disturbance to the species. Disturbance due to oil and gas development, urban developments, ranching, hay production, and transportation has eliminated an unknown portion of potential mountain plover nesting habitat in the vicinity of the VBPA. Disturbance associated with oil and gas and other developments is dispersed throughout the region. Surface disturbance resulting from the Proposed Action would slightly increase cumulative impacts to mountain plovers, but such impacts are likely to remain negligible for the foreseeable future, and the BLM believes that the extent of this habitat removal does not jeopardize plover populations.

4.2.4.5 Unavoidable Adverse Impacts

A small portion of the VBPA would no longer be available as foraging habitat for bald eagle or nesting habitat for mountain plover for the LOP.

4.3 CULTURAL RESOURCES

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a) and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with cultural resources:

- design cultural resource management actions to maintain the value of cultural resources;
- expand the opportunities for scientific study and educational and interpretive uses of cultural resources;
- protect and preserve important cultural resources or their historic record for future generations;
- resolve conflicts between cultural resources and other resource uses; and
- conserve and develop historic resources for the benefit of present and future generations.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.3.1 The Proposed Action

Potential impacts to specific eligible or unevaluated properties are unknown at this time; however, it is likely that project construction activities would uncover cultural resource sites, and some of these sites would be NRHP eligible. Potential direct impacts to NRHP-eligible cultural properties would result primarily from construction-related activities; however, since these potential impacts would be mitigated on a case-by-case basis as determined during site-specific APD and ROW reviews, following procedures promulgated under the *National Historic Preservation Act* (NHPA) at 36 C.F.R. 800 and/or the NCPA and WSP, impacts would not be significant.

Contributing segments of the Cherokee Trail and Rock Springs to Browns Park Road would be avoided on federal, state, and minimal private lands (subject to landowner preference or agreement) as necessary during construction. To provide a protective corridor for the Cherokee Trail within the VBPA, general visual intrusion and surface disturbance would be restricted or prohibited within 1.0 mi of the general trail corridor until the trail is comprehensively mapped, evaluated, and marked on the ground. Therefore, impacts to the trail and/or road would not be significant.

Some increase in indirect impacts to cultural resources, (e.g., unauthorized collection of artifacts) would occur due to increased access to the area. However, these impacts would be reduced due, in part, to the enforcement of ARPA, and inventories and monitoring would locate most significant sites within and adjacent to disturbance areas.

Consultations with Native American groups would be conducted if religious or culturally important sites are identified within the VBPA, and the BLM would review the potential impacts on a site-specific basis to determine what measures are necessary to prevent or mitigate significant impacts to religious or culturally important areas. Surveys to determine the presence of eligible cultural resources, applicant-committed practices (Section 2.1.13.10), and continued consultation with Native American groups, as necessary, would assure that overall impacts to cultural resources from the Proposed Action would not be significant.

4.3.2 No Action Alternative

Under the No Action Alternative, no additional impacts to cultural and historic resources beyond currently authorized levels would occur.

4.3.3 Mitigation and Monitoring

The following measures may be required by the BLM.

Impacts to cultural resources would be mitigated following procedures as specified in 36 C.F.R. 800 and/or the national programmatic agreement for cultural resources and statewide protocol. Class I and Class III inventories would be conducted prior to disturbance on all federal lands and on state and private lands affected by federal undertakings. Where landowners deny access, alternative cultural resource mitigation resolution methodologies may be applied or the development may be denied. In selective areas identified by the BLM, cultural resource surveys may require testing and/or mitigation to determine significance. All resources identified during these inventories would be evaluated for eligibility for the NRHP by the BLM, and SHPO would be consulted as necessary under the statewide protocol. In addition, all eligible or listed sites identified in Class I and Class III inventories would be avoided or mitigated, as would areas with high potential for significant cultural deposits, such as aeolian deposits, alluvial deposits along perennial waterways and other major drainages and terraces, and colluvial deposits at the base of low slopes and hills, where possible. If any NRHP-eligible or -listed sites found within proposed disturbance areas cannot be avoided, a data recovery program or other mitigation would be implemented as deemed appropriate by the BLM in consultation with SHPO, the Advisory Council on Historic Preservation, as necessary, and the Operators. Cultural sites identified during inventories would be avoided, where possible.

If a large number of sites cannot be avoided or other adverse effects could occur, a programmatic agreement among the aforementioned parties may be developed. Programmatic agreements would usually be in place when properties are subjected to mitigation through data recovery. Additionally, programmatic agreements and/or discovery plans may be required to be in place prior to approval of APDs or ROW applications in areas with high densities of cultural resource sites which may occur along culturally sensitive areas such as Vermillion Creek.

In addition to Class I and Class III inventories, construction activities in areas where the BLM believes there is a high potential for buried cultural deposits may be monitored by a BLM-permitted archaeologist. If historic or prehistoric materials are discovered during construction, further surface-disturbing activities at the site (in an area defined by the Authorized Officer) would cease immediately, and appropriate BLM personnel would be notified by the Operators to assure proper handling of the discovery by qualified archaeologists. An evaluation would be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural resources. Operators may be responsible for the cost of site evaluation and mitigation, and any decision as to proper mitigation measures (e.g., data recovery) would be made by the Authorized Officer after consulting with SHPO, the Advisory Council on Historic Preservation, as appropriate, and the Operators.

The BLM may require that all field personnel be informed by Operators of the importance of cultural resources and the regulatory obligations to protect such resources. Any cultural resource (historic or prehistoric site or object) discovered on public land by the Operators or any person working on their behalf would be immediately reported to the Authorized Officer. The BLM may require Operators to instruct field personnel not to disturb cultural resource sites or collect artifacts and that disturbance and collection of cultural materials is prohibited by law.

The BLM may require that a 2-mi wide protective management corridor be established along the general route of the Cherokee Trail until the exact trail route is identified in a single comprehensive study. The study may be funded by the Operators and use aerial reconnaissance to identify and mark the trail. Once marked, the BLM, in consultation with SHPO, may implement other less restrictive management measures.

4.3.4 Cumulative Impacts

Disturbance and/or loss of unidentified sites or artifacts could add to the cumulative loss of information about our heritage in the VBPA and throughout the region if these resources are not identified, inventoried, and/or appropriately protected prior to disturbance. However, such losses are not expected since mitigation measures as identified for the Proposed Action would be implemented under all proposed and potential future regional development projects.

4.3.5 Unavoidable Adverse Impacts

Some loss of unidentified sites or artifacts could occur.

4.4 SOCIOECONOMICS

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a) and state (WSLUC 1979) and local (SCBC 1996) land use plans address the following management objectives associated with socioeconomics:

- coordinate land use decisions with economic factors;
- encourage growth in an orderly and efficient manner;
- provide for the socioeconomic betterment through the diversification of the economic base and retention of existing commerce and industry;
- provide opportunity for leasing, exploration, and development of oil and gas while protecting other resource values;
- enhance the tourist industry;
- maintain and protect the beauty of natural vistas; and
- achieve a balance between resource conservation and economic development.

Significant adverse impacts would occur if the proposed project would, on balance, interfere with the realization of any of the above objectives.

4.4.1 The Proposed Action

The Proposed Action would result in the provision of 766.5 worker years of employment for project-involved personnel (see Table 2.3). Much of this employment would utilize local (Sweetwater County) workers, and others would come from other Wyoming locations. The February 2000 unemployment rate (preliminary) in Sweetwater County was 6.6% (WDOE 2000b)--the fifth highest in Wyoming. The statewide unemployment rate for February 2000 was 5.4%. The Proposed Action would help to alleviate unemployment, especially in Sweetwater County, throughout the LOP.

Each shallow well would cost approximately $438,000 to drill, whereas each deep well would cost approximately $5.8 million to drill. Drilling would be accomplished by local companies, so a portion of the monies would remain in local economies and be subject to the "multiplier effect" as it recycles through the economy.

A gas stream of 1 mmcfd would generate $730,000 annually, assuming a gas price of $2.00 per thousand cubic feet (mcf) (Table 4.4). Assuming transportation costs were $0.25/mcf, this 1 mmcfd stream of gas would generate $79,844 in federal royalties, $33,534 in state severance taxes, and $41,918 in county ad valorum taxes annually. Half of the $79,844 in federal royalties would be returned to the state. In addition, property tax revenues would increase due to the increased tax base resulting from capital improvements, and sales tax revenues would increase as local workers spend most of their earnings in local communities.

If all 56 wells are drilled and completed, and each produces an average of 1 mmcfd of natural gas for 15 years, LOP income from the project would be $613.2 million, federal royalties would be $67.1 million, state severance taxes would be $28.2 million, and Sweetwater ad valorum taxes would be $35.2 million (Table 4.5).

Table 4.4 Estimated Annual Income and Tax Revenues Resulting from a One Million Cubic Feet Per Day (1 mmcfd) Stream of Natural Gas, Vermillion Basin Project Area, Sweetwater County, Wyoming.

Item	Value ($)
Gross Annual Income [1]	730,000
Annual Transportation Costs [2]	91,250
Gross Annual Income Less Annual Transportation Costs	638,750
Annual Federal Royalties [3]	79,844
Annual State Severance Taxes [4]	38,325
Annual County and Valorem Taxes [5]	41,918

[1] Assumes 365 mmcfd gas recovered and sold at $2.00 mcf.
[2] Assumes average transportation cost of $0.25 mcf.
[3] Assumes 12.5% royalty on gross annual income less annual transportation costs.
[4] Assumes 6% rate on gross annual income less annual transportation costs.
[5] Assumes 7.5% Sweetwater County rate on gross annual income less annual transportation costs and federal royalties.

Table 4.5 Estimated Income and Tax Revenues for the Proposed Action, Vermillion Basin Project Area, Sweetwater County, Wyoming.

Item	Value ($ million)
LOP Income[1]	613.2
LOP Transportation Costs[2]	76.6
LOP Income Less LOP Transportation Costs	536.6
LOP Federal Royalties[3]	67.1
LOP State Severance Taxes[4]	32.2
LOP County Ad Valorum Taxes[5]	35.2

[1] Assumes 1 mmcfd natural gas from 56 wells for 15 years sold at $ 2.00 mcf.
[2] Assumes average transportation cost of $ 0.25 mcf.
[3] Assumes 12.5% royalty on LOP income less LOP transportation costs.
[4] Assumes 6% rate on LOP income less LOP transportation costs.
[5] Assumes 7.5% Sweetwater County rate on LOP income less LOP transportation costs and LOP federal royalties.

The Proposed Action would not interfere with the realization of any of the objectives of the appropriate land use plans, and would result in numerous beneficial impacts for Sweetwater County, local communities, and the State of Wyoming, especially with regards to employment and tax revenue generation.

4.4.2 The No Action Alternative

None of the financial or employment benefits realized under the Proposed Action would occur under the No Action Alternative.

4.4.3 Mitigation

No additional mitigation is recommended.

4.4.4 Cumulative Impacts

The CIAA for socioeconomics is Sweetwater County. The Proposed Action would be one additional source of jobs in southwestern Wyoming, especially in Sweetwater County, and another source of tax revenues for the county and the state, both of which are desirable outcomes. The No Action Alternative would result in an undesirable outcome regarding employment and tax revenue generation because no additional jobs or tax revenues would be generated from the project.

4.4.5 Unavoidable Adverse Impacts

There would be no unavoidable impacts under the Proposed Action. Under the No Action Alternative, however, financial and employment benefits would not occur.

4.5 LANDOWNERSHIP AND USE

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a), Standards for Healthy Rangelands (BLM 1997b), and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with land use/status:

- manage public lands to support the goals and objectives of other resource programs;
- respond to public demand for land use authorizations;
- acquire administrative and public access, where necessary;
- maintain or improve the quality of land resources in the state;
- coordinate land use decisions with economic factors and needs;
- provide for a cooperative process of local land use planning with other governmental agencies;
- plan for continuing use of agricultural/rural lands and for potential changes in use of these lands;
- plan land use consistent with the orderly development, use, and conservation of renewable and nonrenewable natural resources;
- plan for the provision of public facilities and services, including safe and efficient transportation and utility systems, in coordination with local land use policies, goals, and objectives; and
- minimize conflicts among utility corridor needs, competing land uses, and local land use plans.

The following management objectives, from the previous references, are associated with livestock/grazing management:

- improve forage production and ecological conditions for the benefit of livestock use, wildlife habitat, watershed, and riparian areas;
- maintain, improve, or restore riparian habitat to enhance forage conditions, wildlife habitat, and stream quality; and
- achieve PFC or better on 75% of riparian areas.

The following management objectives, from the previous references, are associated with recreation:

- provide adequate recreational facilities (indoor and outdoor), parks, and open spaces for present and future generations;
- conserve and develop scenic, historic, and unique places;
- meet legal requirements for the health and safety of visitors;
- mitigate conflicts between recreation and other types of resource uses;
- coordinate land use decisions with economic factors;
- enhance the tourist industry; and
- avoid disruption of environmentally sensitive areas or critical habitat by inappropriate recreational, residential, or commercial development.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.5.1 The Proposed Action

Landownership and Use. Under the Proposed Action, the ownership of surface and mineral estates in the VBPA would remain unchanged. Development of oil and gas resources under the proposed project would occur only on lands leased or owned by the area Operators, and rights to develop other leases on the VBPA would not be violated. The current land uses of livestock grazing, natural gas production, wildlife habitat, and recreation (primarily hunting) would continue during the LOP, although there would be increased emphasis on natural gas production. Natural gas recovery would become a dominant use of the VBPA and would alter the character of the landscape in those areas where it would occur. However, other existing uses would not be excluded. After the LOP, land use would revert to livestock grazing, wildlife habitat, and recreation.

Livestock Grazing. The principal impact to livestock/grazing management would be the direct impact of removal of forage for the construction of well locations, roads, and pipeline ROWs. Short-term removal of vegetative cover from 505 acres would remove that land from production for a few years until revegetation is successful, at which time grasses--the preferred diet of cattle and wild horses--would be more abundant than prior to disturbance. Disturbance would be greatest in the Vermillion Creek allotment where approximately 34 wells are proposed, resulting in approximately 301 acres of new short-term disturbance and 702 acres of total LOP disturbance, including existing disturbance that would be used for the Proposed Action, resulting in a loss of 57 AUMs (0.4% of AUMs in the allotment) (Table 4.6). Disturbance in the other four allotments would result in a loss of 16 AUMs in the Alkali Creek allotment, 53 AUMs in the Crooked Wash allotment, 3 AUMs in the Horseshoe Wash allotment, and 6 AUMs in the Pine Mountain allotment. These losses would represent 0.7%, 2.3%, 0.5%, and 0.01% of the AUMs in the four allotments, respectively.

Table 4.6 Acreage of Proposed and Existing Disturbance in Grazing Allotments, Vermillion Basin Project Area, Sweetwater County, Wyoming.

			Disturbance				
Allotment	Total Acreage	Acres/ AUMs	Existing	Proposed Short-term	Proposed LOP	Total LOP[1]	Annual LOP Loss of AUMs (%)
Vermillion Creek	149,193	12.3	602	301	100	702	57 (0.4)
Alkali Creek	29,226	12.8	153	168	56	209	16 (0.7)
Crooked Wash	11,143	4.9	262	0	0	262	53 (2.3)
Horseshoe Wash	7,663	12.6	33	23	6	39	3 (0.5)
Pine Mountain	70,632	9.1	55	13	3	58	6 (0.01)
Total	267,857	10.34[2]	1,105	505	165	1,048	135

[1] Sum of existing disturbance (to be used by Proposed Action) and proposed LOP disturbance.

[2] Average.

The construction of additional roads and associated reclamation efforts could affect the pattern of livestock forage utilization on the VBPA and could concentrate animals along roads and on reclaimed areas, thus increasing the chances of vehicle/livestock collisions. However, the BLM, Operators, and livestock permittees would monitor livestock movements and appropriate measures would be taken to correct any such movements that produce undesirable results (see Section 2.1.13.12). Construction and drilling activities could contribute to livestock movement off uplands to concentrate in riparian and reclamation areas, thereby impeding reclamation success; however, this would be unlikely because construction and drilling activities are very localized. Applicant-committed practices would ensure that natural gas development activities would not interfere with lambing operations, and that vehicle/livestock collisions would be minimized (see Section 2.1.13.12). Operators would repair fences, cattleguards, gates, etc., potentially damaged during construction to maintain current BLM standards. Livestock would be protected from pipeline trenches and livestock access to water would be maintained (see Section 2.1.13.12).

The Proposed Action would be in compliance with management objectives for livestock grazing and would result in no significant impacts to grazing in the VBPA.

Recreation. No developed recreation sites or facilities or ACECs exist in the VBPA; therefore, none would be affected. Regulations and applicant-committed practices would ensure that management objectives for the PMMA would be not be violated. All existing recreational activities would continue on the project area under the Proposed Action at near existing participation levels. Hunters would have to avoid areas of human activity such as construction, drilling, and completion and would have to pay more attention to the area behind their target to avoid injury and property damage. The project area would become less appealing to some people as an area to recreate because of the additional gas development; however, much of the VBPA--especially the southeastern portion--will not be drilled or developed under the Proposed Action, and recreation in those undeveloped areas would not be affected by the Proposed Action. During the drilling and construction phase, noise, dust, traffic, the presence of equipment, and associated human activities would change the character of the area and diminish some recreational experiences, such as backcountry hiking and camping, wild horse and wildlife observation, horseback riding, nature photography, and big game hunting; however, these would be localized and, in some cases, short-term. The Proposed Action is not anticipated to result in significantly reduced populations of game animals; therefore impacts to most hunters and hunting would not be significant. Increased accessibility throughout the VBPA would enhance opportunities for hunting and wildlife and wild horse observation for some recreational users. Some roads may be retained upon project completion, thereby allowing a permanent increase in some recreational uses of the area. The opportunities for recreation on the VBPA after the LOP would return to existing levels. In summary, then, no significant impacts would occur as a result of the Proposed Action.

4.5.2 No Action Alternative

Under the No Action Alternative, there would be no change in landownership or use from existing conditions, and grazing would remain much the same as existing conditions. Recreational use would continue at approximately present levels of participation.

4.5.3 Mitigation

The BLM may require that roads on federal lands be designed by a licensed, professional engineer, and where proposed roads would follow existing roads, those portions of existing roads not included in the new road ROW and not needed by other area users may be reclaimed and revegetated by the Operators following Class III cultural resource surveys. In addition, the BLM may require the construction of adequate turnouts on new crown-and-ditch roads to provide access from these new roads to existing two-tracks and other undeveloped roads, and may limit local and resource road disturbance area widths to 40 ft or less.

Fencing could be required by the BLM to keep livestock away from any pits containing fluids to prevent ingestion of contaminated water.

4.5.4 Cumulative Impacts

The CIAA for landownership and use is the VBPA; therefore, cumulative impacts are the same as impacts for the Proposed Action and the No Action Alternative. There would be no change in landownership, and existing land uses would continue for the LOP, although natural gas production would be emphasized. After the LOP, land use would revert to pre-development use.

4.5.5 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to landownership and use. The Proposed Action would result in the loss of livestock forage and available AUMs. A negligible amount of opportunity for dispersed outdoor recreation may be lost on the VBPA for the LOP.

4.6 AESTHETICS AND VISUAL RESOURCES

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a) and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with visual resources:

- maintain or improve scenic values and visual quality and to establish priorities for managing the visual resources in conjunction with other resource values and
- conserve and develop scenic resources for the benefit of present and future generations.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.6.1 The Proposed Action

Implementation of the Proposed Action would result in a long-term change in the visual characteristics of the VBPA from a relatively undisturbed area to a more developed natural gas field. However, approximately 82,778 acres (89.5%) of the VBPA is classified as VRM Class IV, and the development anticipated for the Proposed Action would be compatible with that classification given that Operators would utilize existing topography to screen roads, pipelines, and well pads, and would paint aboveground production facilities to blend with adjacent terrain (see Section 2.1.13.16). The remaining 9,712 acres (10.5%) of the VBPA is within the PMMA (VRM Class III area) and would be managed to partially retain the existing character of the landscape. Any action and/or disturbances would be considered and analyzed on a case-by-case basis. Controls may be placed on the amount, sequence, timing, or level of activity or development that may occur to assure that the actions would be consistent with or help meet the management objectives for the area. Therefore, impacts to visual resources associated with activities in the PMMA are not anticipated to be noticeable to the casual observer, and no significant impacts would occur in the PMMA or the VBPA.

4.6.2 No Action Alternative

Under the No Action Alternative, there would be no impacts to visual resources other than those that presently exist.

4.6.3 Mitigation

The BLM may require that all temporary water supply pipelines be located within road or gathering system pipeline ROWs.

4.6.4 Cumulative Impacts

The CIAA for aesthetics and visual resources is the VBPA. The majority of the VBPA is VRM Class IV with which oil and gas development is compatible assuming reasonable mitigation is included. Such mitigation is included in the Proposed Action and cumulative impacts to visual resources would not be significant.

4.6.5 Unavoidable Adverse Impacts

The addition of gas development and production facilities and associated roads would be an unavoidable adverse impact to visual resources. This impact would occur throughout the LOP and for some time into the future, since reclaimed lands may take many years to assume predisturbance visual characteristics.

4.7 HAZARDOUS MATERIALS

The GRRA RMP and ROD (BLM 1992, 1996a, 1997a) and state (WSLUC 1979) and local (SCBC 1996) land use plans prescribe the following management objectives associated with hazardous materials:

- protect public and environmental health and safety on BLM-administered public lands;
- comply with applicable federal and state laws;
- prevent waste contamination due to any BLM-authorized actions;

- minimize federal exposure to the liabilities associated with waste management on public lands; and
- integrate hazardous materials and waste management policies and controls into all BLM programs.

Failure to comply with one or more of these management objectives could result in significant impacts.

4.7.1 The Proposed Action

Impacts to soils, surface and ground water resources, and wildlife could result from accidental hazardous materials spills, pipeline ruptures, and/or exposure to hazardous materials. It is likely that only small amounts of soil potentially would be contaminated and, if this occurs, the affected area would be cleaned up in an appropriate and timely manner.

Proper containment of oil and fuel in storage areas, containment of fluids in reserve pits, appropriate pipeline design and construction, proper well casing and cementing, and location of wells away from drainages would prevent potential surface and ground water contamination (see Section 2.1.13.17). Project operations would comply with all relevant federal and state laws regarding hazardous materials and with directives identified in existing SPCC Plans. Birds and mammals would be excluded from reserve pits that contain potentially harmful substances by installation of fences and/or netting (see Section 2.1.13.9). No significant impacts would occur due to hazardous materials.

4.7.2 No Action Alternative

Under the No Action Alternative the possibilities for environmental damage due to hazardous materials would remain at existing levels.

4.7.3 Mitigation

The BLM may require Operators to provide an impervious liner under some or all tank batteries in the VBPA.

4.7.4 Cumulative Impacts

The CIAA for hazardous materials is the VBPA and a 2-mi buffer. Little additional disturbance is anticipated in the 2-mi buffer around the VBPA other than some road upgrades that would disturb relatively small areas adjacent to existing disturbance. No significant cumulative impacts associated with hazardous materials are anticipated.

4.7.5 Unavoidable Adverse Impacts

Some small spills of, or exposure to, hazardous materials could occur; however, with implementation of appropriate precautions as outlined in Chapter 2.0, such occurrences would be minimized.

4.8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible and irretrievable commitment of resources is defined as a permanent reduction or loss of a resource that, once lost, cannot be regained. The primary irreversible and irretrievable commitment of resources from the proposed project would be the removal and use of the gas and oil reserves. Other irreversible and irretrievable commitments of resources would include soil lost through wind and water erosion; loss of productivity (i.e., forage, wildlife habitat) from lands devoted to project activities during the time those lands are out of production and until they are revegetated; inadvertent or accidental destruction of paleontological or cultural resources during construction and increases in illegal collecting; loss of animals due to mortality during earthmoving activities or by collisions with vehicles; and labor, materials, and energy expended during construction, drilling, production, and reclamation activities associated with the project.

4.9 SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

For purposes of this EA, short-term use of the environment is that use during the LOP, whereas long-term productivity refers to the period after the project is completed and the area is reclaimed and revegetated. Short-term use of the environment would not affect the long-term productivity of the VBPA or adjacent areas. After the project is completed and disturbed areas reclaimed, the same resources that were present prior to the project would be available, except for the oil and gas that has been recovered. It may take 20 years or more after the LOP for some of the reclaimed areas to have shrub conditions comparable to predisturbance levels; however, reclamation would provide conditions to support wildlife, livestock, and recreation. Use of the project area during the LOP would not preclude the subsequent long-term use of the area for any purpose for which it was suited prior to the project.

5.0 RECORD OF PERSONS, GROUPS, AND GOVERNMENTAL AGENCIES CONTACTED

Table 5.1 General Record of Persons, Groups, and Governmental Agencies Contacted.[1]

Company/Agency	Individual	Discipline/Position
Basin Exploration	Jerry Gentry	--
Bjork, Lindley, Danielson and Baker, P.C.	Laura Lindley	--
Colorado Natural Heritage Program	Beth Van Dusen	Environmental Review Coordinator
Erathem-Vanir Geological Consultants	Gustav Winterfeld	Geologist
Evergreen Resources, Inc.	Gerald Jacob	Environmental Supervisor
Individual	Craig Thompson	Citizen
Individual	Larry and LaVeta Pennock	Citizens
Marathon Oil Company	Joseph C. Icenogle	Advanced Landman
Office of Federal Land Policy	Julie Hamilton	Planning Consultant
Petroleum Association of Wyoming	Curtis Parsons	Chairman
Questar Exploration and Production	Steve Williams	General Manager
Southwest Wyoming Industrial Association	Don Hartley	Director
Oregon/California Trails Association	Don Hartley	Wyoming Preservation Officer
State of Wyoming		
Department of Parks and Cultural Resources	Judy K. Wolf	Deputy State Historic Preservation Officer
Sweetwater County		
Sweetwater County Commissioners	Carl Maldonado	Chairman
Sweetwater County Weed and Pest Control	Jim Cotterman	Supervisor
Texaco Exploration and Production, Inc.	Dallas C. Bennett	Production Supervisor
U.S. Army Corps of Engineers, Wyoming Regulatory Office	Matthew A. Bilodeau	Program Director

Table 5.1 (Continued)

Company/Agency	Individual	Discipline/Position
U.S. Bureau of Land Management	Teri Deakins	Project Manager
	Susan Caplan	Air Quality
	Thor Stephenson	Wild Horse, Range Management Specialist
	Jim Dunder	Wildlife Biologist
	Jim Glennon	Sensitive Plants
	Vicky Herren	Wildlife Biologist
	George Schoenfeld	Natural Resource Specialist
	John MacDonald	Soil Scientist
	Russ Tanner	Cultural Resources
	Dave Valenzuela	Geologist
U.S. Fish and Wildlife Service, Wyoming Office	Michael M. Long	Field Supervisor
Wexpro	Cathy Flansburg	Regulatory Affairs Coordinator
	Jeffrey Ingerson	Environmental Specialist
	James Livsey	Coordinating General Manager
	G.T. Nimmo	Operations Manager
Wyoming Department of Transportation	James J. Montuoro	District Traffic Engineer
Wyoming Game and Fish Department		
Cheyenne	Steve Facciani	Deputy Director
	Kerry Olson	Wildlife Biologist
Green River	Tom Christiansen	Wildlife Biologist
	Ron Remmick	Fisheries Biologist
Wyoming Geological Survey	Jim Case	Geologist
Wyoming State Geological Survey	Lance Cook	State Geologist
Wyoming Natural Diversity Database	Rebekah Smith	Data and Biological Assistant
Wyoming Oil and Gas Commission	Nancy Barclay	–

---

[1] Additional individuals, groups, and agencies were contacted during scoping.

Table 5.2 List of Preparers.

Firm/Company	Name	EA Responsibility
TRC Mariah Associates Inc.	S.L. Tiger Adolf	Technical Editing, Document Production
	Genial DeCastro	Document Production/Quality Control
	Pete Guernsey	Project Management, EA Preparation, Quality Assurance/Quality Control
	Jan K. Hart	Data Gathering, EA Preparation
	Carolyn Hayden	Document Production
	Tamara Linse	Document Production
	James Lowe	Cultural Resources
	Suzanne Luhr	Cartography
	Roger Schoumacher	EA Preparation, Quality Assurance/ Quality Control
	Craig Smith	Cultural Resources/Quality Assurance/ Quality Control
	Gus Winterfeld	Paleontology (Erathem-Vanir)
Bureau of Land Management, Interdisciplinary Team		
Rock Springs Field Office	Susan Caplan	Air Quality
	Teri Deakins	Project Manager
	Dennis Doncaster	Hydrology, Water Resources
	Jim Dunder	Vegetation, Grazing
	Jim Glennon	Sensitive Plants
	Vicki Herren	Wildlife
	John MacDonald	Soils
	Judy Mueller	Lands/Realty
	George Schoenfeld	Transportation, Hazardous Materials
	Thor Stephenson	Wild Horses
	Russ Tanner	Cultural Resources
	Dave Valenzuela	Geology, Paleontology

6.0 REFERENCES

Avian Power Line Interaction Committee. 1994. Mitigating bird collisions with power lines: The state of the art in 1994. Edison Electric Institute, Washington, D.C. 78 pp. + append.

_____. 1996. Suggested practices for raptor protection on power lines: The state of the art in 1996. Edison Electric Institute/Raptor Research Foundation. Washington, D.C.

Baldwin, P.H. 1971. Diet of the Mountain Plover at the Pawnee National Grassland, 1970-71. U.S. IBP Grassland Biome Program Report 134. Colorado State University, Fort Collins, Colorado. 34 pp.

Baxter, G.T., and J.R. Simon. 1970. Wyoming Fishes. Bulletin No. 4, Wyoming Game and Fish Department, Cheyenne, Wyoming. 168 pp.

Baxter, G.T., and M.D. Stone. 1985. Amphibians and reptiles of Wyoming. Second edition. Wyoming Game and Fish Department, Cheyenne, Wyoming. 137 pp.

Bureau of Land Management. 1979. Soil Inventory of the Salt Wells Area. Prepared by SALUT, Columbia, Maryland.

_____. 1985. Manual 9113: Roads. Engineering, Rel. 9-247. U.S. Department of the Interior, Bureau of Land Management.

_____. 1986a. Oregon Mormon Pioneer National Historic Trails management plan. U.S. Department of the Interior, Bureau of Land Management. BLM-WY-86-007-4333. 244 pp.

_____. 1986b. Draft Little Snake Resource Management Plan and Environmental Impact Statement, Moffat, Rio Blanco, and Routt Counties, Colorado. U.S. Department of the Interior, Bureau of Land Management, Craig, Colorado District, Little Snake Resource Area. February 1986.

_____. 1986c. Final Little Snake Resource Management Plan and Environmental Impact Statement, Moffat, Rio Blanco, and Routt Counties, Colorado. U.S. Department of the Interior, Bureau of Land Management, Craig, Colorado District, Little Snake Resource Area. September 1986.

_____. 1988. National Environmental Policy Act handbook, H-1790-1. U.S. Department of the Interior, Bureau of Land Management.

_____. 1989. Little Snake Resource Management Plan and Record of Decision, Moffat, Rio Blanco, and Routt Counties, Colorado. U.S. Department of the Interior, Bureau of Land Management, Craig District, Little Snake Resource Area. June 1989.

_____. 1990a. Wyoming policy on reclamation. U.S. Department of the Interior, Bureau of Land Management, Rawlins District Office, Rawlins, Wyoming.

_____. 1990b. Bureau of Land Management Manual Section 9112: Bridges and Major Culverts.

_____. 1991a. Wyoming supplement to the Bureau 9113 Manual. U.S. Department of the Interior, Bureau of Land Management, Wyoming State Office, Cheyenne, Wyoming. 16 pp.

_____. 1991b. PG&E Resource Company Fontanelle II unit infill drilling program environmental assessment WY-048-EA-91-54. Prepared for U.S. Department of Interior, Bureau of Land Management, Rock Springs District, Rock Springs, Wyoming, by PIC Technologies, Denver, Colorado.

_____. 1992. Green River Resource Area management plan and draft environmental impact statement. U.S. Department of the Interior, Bureau of Land Management, Rock Springs District, Rock Springs, Wyoming, BLM-WY-ES-92-019-4410. 901 pp.

_____. 1994. Guidelines for assessing and documenting cumulative impacts. U.S. Department of the Interior, Bureau of Land Management, Information Bulletin No. 97-310. 69 pp.

_____. 1995. Resource management plan amendment and environmental assessment for black-footed ferret reintroduction, Little Snake Resource Area. Prepared for Bureau of Land Management, Little Snake Resource Area, U.S. Fish and Wildlife Service (Region 6), and the Colorado Division of Wildlife (Northwest Region). 23 pp.

_____. 1996a. Green River Resource Area resource management plan and final environmental impact statement. U.S. Department of Interior, Bureau of Land Management, Rock Springs District, Rock Springs, Wyoming, BLM/WY/PL-96/012+1610. 1,009 pp.

_____. 1996b. Overview of BLM's NEPA Process. Bureau of Land Management, National Training Center Course Number 1620-02.

_____. 1997a. Record of Decision for the Green River Resource Area Management Plan and environmental impact statement. U.S. Department of Interior, Bureau of Land Management, Rock Springs District, Rock Springs, Wyoming.

______. 1997b. Standards for healthy rangelands and guidelines for livestock grazing management for public lands administered by the Bureau of Land Management in the State of Wyoming. U.S. Department of Interior, Bureau of Land Management, Cheyenne, Wyoming. BLM/WY/AE-97-023+1020. 16 pp.

______. 1998a. Hazardous materials summary for the Continental Divide/Wamsutter II Project. Prepared for Bureau of Land Management, Great Divide Resource Area, Rawlins District, Rawlins, Wyoming, and Green River Resource Area, Rock Springs District, Rock Springs, Wyoming, by TRC Mariah Associates Inc., Laramie, Wyoming.

______. 1998b. A user guide to assessing proper functioning condition and supporting science for lotic areas. U.S. Department of Interior, Bureau of Land Management, Technical Reference TR1737-15.

______. 1998c. Final Environmental Impact Statement, Jonah Field II Natural Gas Project. Bureau of Land Management, Pinedale and Green River Resource Area, Rock Springs District, Rock Springs, Wyoming.

______. 1999a. Draft environmental impact statement, Continental Divide/Wamsutter II natural gas project, Sweetwater and Carbon Counties, Wyoming. Bureau of Land Management, Great Divide Resource Area, Rawlins, Wyoming, and Green River Resource Area, Rock Springs, Wyoming.

______. 1999b. Draft environmental impact statement for the Pinedale Anticline oil and gas exploration and development project, Sublette County. Prepared by Bureau of Land Management, Pinedale Field Office, Pinedale, Wyoming, in Cooperation with the U.S. Army Corps of Engineers, U.S. Forest Service, and State of Wyoming. November 1999.

______. 1999c. Pinedale Anticline oil and gas exploration and development project draft environmental impact statement, technical report. Sublette County, Wyoming. Prepared by Bureau of Land Management, Pinedale Field Office, Pinedale, Wyoming in Cooperation with the U.S. Army Corps of Engineers, U.S. Forest Service, and State of Wyoming. November 1999.

______. 1999d. Air quality impact assessment technical support document, Continental Divide/Wamsutter II and South Baggs Natural Gas Development Projects environmental impact statement. Prepared for U.S. Department of Interior, Bureau of Land Management, Rawlins Field Office, Rawlins, Wyoming, and Rock Springs Field Office, Rock Springs, Wyoming, by TRC Environmental Corporation, Windsor, Connecticut, and Earth Tech, Inc., Concord, Massachusetts.

_____. 1999e. Revised air quality impact assessment technical support document, Continental Divide/Wamsutter II and South Baggs Projects. U.S. Department of the Interior, Bureau of Land Management, Rawlins and Rock Springs Field Office. Rawlins and Rock Springs, Wyoming.

_____. 2000. Biological Assessment for the Vermillion Basin Natural Gas Development Project. Bureau of Land Management, Rock Springs, Wyoming.

Call, M.W. 1978. Nesting Habitats and Surveying Techniques for Common Western Raptors. U.S. Department of the Interior, Bureau of Land Management, Technical Note No. 316. 115 pp.

Case, J.C. 1999. Basic Seismological Characterization for the Little Snake Supplemental Irrigation Water Supply Project, Southern Carbon County, Wyoming. Wyoming State Geological Survey, Laramie, Wyoming. 21 pp.

Case, J.C., L.L. Larsen, C.S. Boyd, and J.C. Cannia (compilers). 1995. Earthquake epicenters and suspected active faults with surficial expression in Wyoming (1:1,000,000 scale map). Wyoming State Geological Survey, Laramie, Wyoming.

Clark, T.W., and M.R. Stromberg. 1987. Mammals in Wyoming. University of Kansas, Museum of Natural History, Public Education Series No. 10. 314 pp.

Collentine, M., R. Libra, K.R. Feathers, and L. Hamden. 1981. Occurrence and characteristics of groundwater in the Great Divide and Washakie Basins, Wyoming. Vol. V1-A, Vol. V1-B. Water Resources Research Institute, University of Wyoming, Laramie. 112 pp. + append. + maps.

Colorado Natural Heritage Program. 2000. Letter from Beth Van Dusen to Jan Hart, TRC Mariah Associates Inc. regarding elements of concern in T12N, R100 and 101W. January 31, 2000. 6 pp.

Dinsmore, J.J. 1983. Mountain Plover (*Charadrius montanus*). *In* Impacts of Coal Surface Mining on 25 Migratory Bird Species of High Federal Interest, J.S. Armbruster (editor), pp. 185-196. Department of the Interior, U.S. Fish and Wildlife Service, FWS/OBS-83/85. 348 pp.

Dorn, J.L., and R.D. Dorn. 1990. Wyoming Birds. Mountain West Publishing, Cheyenne, Wyoming. 138 pp.

Easterly, T., A. Wood, and T. Litchfield. 1991. Responses of pronghorn and mule deer to petroleum development on crucial winter range in the Rattlesnake Hills. Wyoming Game and Fish Department, Cheyenne, Wyoming. 67 pp.

Edwards, C.C. 1969. Winter Behavior and Population Dynamics of American Eagles in Utah. Ph.D. dissertation, Brigham Young University, Provo, Utah. 156 pp.

Erathem-Vanir Geological Consultants and TRC Mariah Associates Inc. 2000. In progress. Non-field paleontological resource evaluation for the Vermillion Basin Project.

Fertig, W. 1994. Wyoming Rare Plant Field Guide. Prepared for the Bureau of Land Management, the U.S. Forest Service, and the U.S. Fish and Wildlife Service by the Wyoming Rare Plant Technical Committee.

_____. 1999. Blowout penstemon: Wyoming's first endangered plant species. Http://uwsdmnweb.uwyo.edu/wyndd/What's_new_blowout_penstemon.htm.

Fletcher, J.E., P.K.A. Fletcher, and L. Whiteley. 1999. Cherokee Trail Diaries. Volume 1-1849: A New Route to the California Gold Fields; Volume II-1850: Another New Route to the Gold Fields of California. Published by the Fletcher Family Foundation, Sequim, Washington. Printed and bound by Caxton Printers, Ltd., Caldwell, Idaho.

Forrest, S.C., T.W. Clark, L. Richardson, and T.M. Campbell III. 1985. Black-footed ferret habitat: Some management and reintroduction considerations. Wyoming Bureau of Land Management Wildlife Technical Bulletin No. 2. 49 pp.

Geo/Resource Consultants. 1984. Green River Basin Geologic Resources Inventory. Geo/Resource Consultants, San Francisco, California.

Graul, W.D., and L.E. Webster. 1976. Breeding status of the mountain plover. Condor 78:265-267.

Guenzel, R.J. 1986. Pronghorn ecology in southcentral Wyoming. M.S. thesis, University of Wyoming, Laramie. 347 pp.

_____. 1987. Rattlesnake antelope. Pages 146-183 *In* District 7, 1987 Annual Big Game Herd Unit Reports. Wyoming Game and Fish Department, Cheyenne.

Gusey, W.F. 1986. Terrestrial wildlife and the petroleum industry: Interactions and relationships. Draft Report. Shell Oil Company, Houston, Texas.

Klipple, G.E., and D.F. Costello. 1960. Vegetation and cattle responses to different intensities of grazing on short-grass ranges on the Central Great Plains. U.S. Department of Agriculture Technical Bulletin 1216. 82 pp.

Knopf, F.L. 1994. Avian assemblages on altered grasslands. Studies in Avian Biology 15:247-257.

_____. 1996. Mountain Plover. Birds of North America, No. 211.

Love, J.D., and A.C. Christiansen. 1985. Geologic map of Wyoming. U.S. Geological Survey, Denver, Colorado.

Love, J.D., A.C. Christiansen, and A.J. Ver Ploeg (compilers). 1993. Stratigraphic chart showing Phanerozoic nomenclature for the State of Wyoming. The Geological Survey of Wyoming. Map Series 41

Matthews, J.R. (editor). 1990. The Official World Wildlife Fund Guide to Endangered Species of North America. Volume 2. Beacham Publishing Company, Washington, D.C.

National Park Service. 1999. Management plan and use plan update, Final Environmental Impact Statement: Oregon National Historic Trail, Mormon Pioneer National Historic Trail. U.S. Department of the Interior, National Park Service, Denver Service Center, Denver, Colorado. NPS D-9A/June 1999. 371 pp.

Olendorff, R.R., A.D. Miller, and R.M. Lehman. 1981. Suggested practices for raptor protection on power lines: The state of the art in 1981. Raptor Research Report No. 4, Raptor Research Foundation, Inc., University of Minnesota, St. Paul. 111 pp.

Parrish, T.L., S.H. Anderson, and W.F. Oelklaus. 1993. Mountain plover habitat selection in the Powder River Basin, Wyoming. Prairie Naturalist 25(3):219-226.

Peterson, A. 1986. Habitat suitability index models: Bald eagle (breeding season). U.S. Fish and Wildlife Service Biological Report 82(10.126). 25 pp.

Questar Applied Technologies. 1999. Unpublished gas composition data, Canyon Creek-Vermillion Complex, Vermillion Creek, Pioneer Kinney, and Trail Creek Units (45 wells).

Reeve, A.F. 1984. Environmental Influences on Male Pronghorn Home Range and Pronghorn Behavior. Ph.D. Dissertation, University of Wyoming, Laramie, Wyoming. 172 pp.

Roehler, H.W. 1973a. Geological Map of the Erickson-Kent Ranch Quadrangle, Sweetwater County, Wyoming. USGS Geological Quadrangle Map GQ-1438. Scale 1:24,000.

_____. 1973b. Geological Map of the Chicken Creek East Quadrangle, Sweetwater County, Wyoming. USGS Geological Quadrangle Map GQ-1128. Scale 1:24,000.

_____. 1974. Geological Map of the Chicken Creek West Quadrangle, Sweetwater County, Wyoming. USGS Geological Quadrangle Map GQ-1139. Scale 1:24,000.

_____. 1974b. Geological Map of the Scrivner Butte Quadrangle, Sweetwater County, Wyoming. USGS Geological Quadrangle Map GQ-1166. Scale 1:24,000.

_____. 1978a. Geological Map of the Chicken Creek SW Quadrangle, Sweetwater County, Wyoming. USGS Geological Quadrangle Map GQ-1443. Scale 1:24,000.

_____. 1978b. Geological Map of the Chicken Creek SE Quadrangle, Sweetwater County, Wyoming. USGS Geological Quadrangle Map GQ-1454. Scale 1:24,000.

_____. 1985. Geological Map of the Kinney Rim 30 minute x 60 minute Quadrangle, Wyoming and Colorado. USGS Miscellaneous Investigation Series Map I-1615. Scale 1:100,000.

Root, F.K., G.B. Glass, and D.W. Land. 1973. Sweetwater County, Wyoming. Wyoming State Geological Survey Publication, Country Resource Series, CR-2 Sweetwater County, Wyoming. Scale 1:250,000.

Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski (editors). 1994. The Scientific Basis for Conserving Forest Carnivores: American Martin, Fishes, Lynx and Wolverine in the Western United States. General Technical Report RM-254. U.S. Department of Agriculture, Forest Service, Intermountain and Northern Regions, Fort Collins, Colorado.

Scott, S.L., editor. 1987. Field guide to the birds of North America. Second edition. National Geographic Society, Washington, D.C. 464 pp.

Segerstrom, T.B. 1982. Effects of an operational coal mine on pronghorn antelope. M.S. Thesis, Montana State University, Bozeman, Montana.

Sheets, R.G., R.L. Linder, and R.B. Dahlgren. 1972. Food habits of two litters of black-footed ferrets in South Dakota. American Midland Naturalist 87:249-251.

Snow, C. 1973. Habitat Management Series for Endangered Species. Report No. 5: Southern Bald Eagle (*Haliaeetus leucocephalus leucocephalus*) and Northern Bald Eagle (*H. l. alascanus*). U.S. Department of the Interior, Bureau of Land Management, Technical Note No. 171. 58 pp.

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, the U.S. Forest Service, and the U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program.

Steenhof, K. 1978. Management of Wintering Bald Eagles. U.S. Fish and Wildlife Service FWS/OBS-78/79. 59 pp.

Sweetwater County Board of Commissioners. 1996. Sweetwater County Growth management plan and agreement. 38 pp.

Thumann, A., and R.K. Miller. 1986. Fundamentals of noise control engineering. Prentice-Hall, Englewood Cliffs, New Jersey. 287 pp.

TRC Mariah Associates Inc. 1998. Cultural Resource Overview of the Continental Divide/Wamsutter II Environmental Impact Statement Project Area. Prepared for the Bureau of Land Management, Rawlins and Rock Springs Districts, Great Divide and Green River Resource Areas, Rawlins and Rock Springs, Wyoming, by TRC Mariah Associates Inc., Laramie, Wyoming.

Tyus, H.M., and C.A. Karp. 1989. Habitat Use and Streamflow Needs of Rare and Endangered Fishes, Yampa River, Colorado. U.S. Department of the Interior, Fish and Wildlife Service, Biological Report 89(14). 27 pp.

University of Wyoming. 1996. Southwest Wyoming Bureau of Land Management Planning Area (including Wyoming counties of: Carbon, Lincoln, Sublette, Sweetwater, and Uinta). Prepared by University of Wyoming College of Agriculture, Cooperative Extension Service, Department of Agriculture Economics. 95 pp. + append.

U.S. Department of Commerce. 1990. 1990 census of population. U.S. Department of Commerce, Economics, and Statistics, Bureau of the Census. U.S. Government Printing Office, Washington, D.C.

U.S. Department of the Interior. 1980. Department Manual 516: Environmental quality.

U.S. Department of Transportation Federal Highway Administration. 1992. Local low volume roads and streets. American Society of Civil Engineers.

U.S. Environmental Protection Agency. 1971. Community Noise. U.S. EPA.

U.S. Fish and Wildlife Service. 1987. Final Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin. U.S. Department of the Interior, Fish and Wildlife Service, Region 6, Denver, Colorado.

_____. 1988. Black-footed Ferret Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado. 154 pp.

_____. 1989. Black-footed ferret survey guidelines for compliance with the *Endangered Species Act*. U.S. Fish and Wildlife Service, Denver, Colorado, and Albuquerque, New Mexico. 10 pp. + append.

_____. 1991. Draft national wetlands inventory maps for the Erickson-Kent Ranch, Scrivner Butte, Chicken Creek, Chicken Creek East, Chicken Creek SE, Chicken Creek W, Chicken Creek SW 7.5' Quadrangles.

_____. 1995. A Cooperative Management Plan for Black-footed Ferrets, Little Snake Resource Area. Prepared for Bureau of Land Management, Little Snake Resource Area, U.S. Fish and Wildlife Service (Region 6), and the Colorado Division of Wildlife (Northwest Region). June 1995. 97 pp.

_____. 1999a. Mountain Plover Survey Guidelines. U.S. Fish and Wildlife Service, 1999. Unpublished Copy. 6 pp.

_____. 1999b. Letter from Mike Long (Field Supervisor, U.S. Fish and Wildlife Service) to Stan McKee (Field Manager, Bureau of Land Management) regarding threatened, endangered, proposed, and candidate species which may occur in the Rock Springs District in Wyoming. Case No. ES-61411 pd/W.02 (rocksprings.pd). November 23, 1999.

U.S. Forest Service. 1994a. Record of Decision for the mountain plover management strategy. U.S. Department of Agriculture, Forest Service, Pawnee National Grassland, Arapaho and Roosevelt National Forests, Weld County, Colorado.

_____. 1994b. Final Environmental Impact Statement for Management Strategy for Mountain Plover. U.S. Department of Agriculture, Forest Service, Pawnee National Grassland, Arapaho and Roosevelt National Forests, Weld County, Colorado.

Welder, G.E., and L.J. McGreevy. 1966. Ground-water reconnaissance of the Great Divide and Washakie Basins and some adjacent areas, southwestern Wyoming. U.S. Geological Survey Hydrologic Investigations Atlas HA-219. 9 pp. + maps.

Wiens, J.A., and M.I. Dyer. 1975. Rangeland Avifaunas: Their Composition, Energetics, and Role in the Ecosystem. *In* Symposium on Management of Forest and Range Habitat for Nongame Birds, D.R. Smith, Technical Coordinator, pp. 146-181. U.S. Forest Service General Technical Report WO-1.

Woods & Poole Economics, Inc. 1993. 1993 State profile, Montana and Wyoming. Washington, D.C.

Wyoming Department of Administration and Information. 1991. Wyoming data handbook. Tenth edition. Prepared by the Department of Administration and Information, Division of Economic Analysis. 308 pp.

Wyoming Department of Employment. 2000a. Website - 1mi.state.wy.us/ub/table89.htm

_____. 2000b. Wyoming Labor Force Trends. 37(2):21.

Wyoming Department of Environmental Quality. 1989. Wyoming air quality standards and regulations. Wyoming Department of Environmental Quality, Air Quality Division, Cheyenne, Wyoming. 88 pp.

_____. 1990. Water quality rules and regulations. Chapter I: Quality standards for Wyoming surface waters. Wyoming Department of Environmental Quality, Cheyenne, Wyoming. 87 pp.

_____. 1993. Water quality rules and regulations. Chapter VIII. Quality standards for Wyoming groundwater. Wyoming Department of Environmental Quality, Water Quality Division, Cheyenne, Wyoming. 13 pp.

Wyoming Department of Revenue. 1996. 1996 Annual Report. State of Wyoming, Department of Revenue, Cheyenne, Wyoming.

_____. 1997. Unpublished revenue statistics. Website - http://revenue.state.wy.us.

Wyoming Division of Economic Analysis. 2000. Website - hhtp://eadiv.state.wy.us/p/ctyest98.htm [and] hhtp://eadiv.state.wy.us/wyc&sc98.htm

Wyoming Game and Fish Department. 1991. Wyoming trout stream classification map. Wyoming Game and Fish Department, Cheyenne, Wyoming.

_____. 1992. Wyoming bird and mammal atlas. Biological Services, Game Division, Wyoming Game and Fish Department, Cheyenne, Wyoming. 170 pp.

_____. 1997. Atlas of Birds, Mammals, Reptiles, and Amphibians in Wyoming. Wyoming Game and Fish Department, Wildlife Division, Biological Services Station. Nongame Program, Lander, Wyoming. 192 pp.

_____. 1999. Green River region annual big game herd unit reports, 1998. Wyoming Game and Fish Department, Cheyenne, Wyoming. 342 pp.

_____. n.d. Standardized definitions for seasonal wildlife ranges. Mimeograph. 2 pp.

Wyoming Natural Diversity Database. 2000. Elements of concern in T12N-T14N and R99W-R101W: Database search for Jan Hart, TRC Mariah Associates Inc. Wyoming Natural Diversity Database, The Nature Conservancy, Laramie, Wyoming. 9 pp.

Wyoming Oil and Gas Conservation Commission. 1992. Rules and regulations of Wyoming oil and gas, including rules of practice and procedure. Office of State Oil and Gas Supervisor, Casper, Wyoming. 105 pp. + append.

_____. 1999. Wyoming oil and gas statistics. Casper, Wyoming. CD Rom.

_____. 1998. Rules and regulations of Wyoming Oil and Gas Conservation Commission, including rules of practice and procedure. Office of State Oil and Gas Supervisor, Casper, Wyoming.

Wyoming Rare Plant Technical Committee. 1997. 1997 Wyoming Rare Plant Workshop-Special Status Review Session. 7 pp.

Wyoming State Land Use Commission. 1979. Wyoming state land use plan: A program for land use planning in the State of Wyoming. The Wyoming State Land Use Commission, Cheyenne, Wyoming. 180 pp. + maps.

Wyoming Taxpayers Association. 1996. Wyoming property taxation 1996. Wyoming Taxpayers Association, Cheyenne, Wyoming. 40 pp.

END

12-13-01